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LITERARY AND PHILOSOPHICAL SOCIETY

OF

LIVERPOOL,

DURING THE

SEVENTY-THIRD SESSION, 1883-84.

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ON THE SOCIETY'S ROLL AT THE CLOSE OF THE 73RD SESSION.

CORRECTED TO SEPTEMBER, 1884.

Life Members are marked with an Asterisk.

Oct. 21,	1872	Abbott, Joseph, B.A., 2, *Picton-street, Wavertree-road.*
March 24,	1879	Alexander, William, M.D., 102, *Bedford-street South.*
Nov. 1,	1880	Allen, Francis B., 100, *Newsham Drive, Newsham Park.*
Nov. 12,	1877	Allman, G. W., 4, *Ullet-road, Prince's Park.*
March 7,	1864	Archer, F., B.A., Trin. Col., Cantab., 14, *Cook-street,* and *Boundary Cottage, Little Crosby.*
*Nov. 28,	1858	Archer, T. C., F.R.S.E., F.R.SS.A., Director of the Industrial Museum, *Edinburgh.*
Nov. 29,	1883	Armour, Rev. S. C., M.A., Merchant Taylors' School, *Crosby.*
Nov. 13,	1876	Ball, Geo. Hy., 57, *Hope-street.*
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Nov. 15,	1869	Beer, Joseph B. de, *Northern Assurance-chambers, Tithebarn-street.*
Feb. 22,	1875	Bellew, Thomas A., 28, *Canning-street.*
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Dec. 10, 1866 Benas, Baron Louis, *South Castle-street.*
Jan. 9, 1882 Benas, Phineas A., 74, *Upper Parliament-street.*
Nov. 27, 1865 Biggs, Arthur Worthington, 28, *Exchange-street East*, and 11, *Percy-street.*
Feb. 6, 1882 Birchall, Charles, 32, *Castle-street.*
Jan. 25, 1864 Birchall, James, *Kirkdale*, HON. SECRETARY.
Dec. 16, 1878 Bogue, Robert Lachlan, The College, *Shaw-street.*
Oct. 19, 1868 Bower, Anthony, *Vauxhall Foundry*, and *Bowersdale, Seaforth.*
Oct. 21, 1872 Bowring, C. T., *Elmsleigh, Prince's Park*, and 20, *Lancaster-buildings, Tithebarn-street.*
Feb. 6, 1882 Bradley, A. C., M.A., Professor, University College, Liverpool, 113, *Canning-street.*
Dec. 15, 1873 Brass, Joseph, M.D., 6, *Upper Parliament-street.*
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Oct. 18, 1869 Brown, J. Campbell, D.Sc., F.C.S., Professor of Chemistry, University College, VICE-PRESIDENT.
Jan. 7, 1883 Buchanan, William, 1, *Oriel-chambers, Water-street.*
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March 31, 1884 Burman, Rev. H., 18, *Berkeley-square.*
April 18, 1864 Burne, Joseph, *Royal Insurance Office*, 1, *North John-street.*
Oct. 17, 1881 Burton, Dr., 64, *Rodney-street.*
*May 1, 1848 Byerley, Isaac, F.L.S., F.R.C.S., *Seacombe.*
Jan. 7, 1884 Calder, Miss Fanny, 47, *Canning-street.*
Nov. 3, 1862 Cameron, John, M.D., M.R.C.P., Physician to the Southern Hospital, 4, *Rodney-street.*
March 4, 1872 Carter, W., M.D. Lond., 74, *Rodney-street.*
Dec. 2, 1861 Chadburn, William, 71, *Lord-street.*
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Dec. 18, 1875 Cowell, Peter, Free Library, *William Brown-street.*

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Oct. 6, 1863 Crosfield William, *Stanley Street*, and 16, *Alexandra Drive, Ullet-road.*

Jan. 7, 1884 Currie, John, *Bank of Liverpool, Water-street.*

Nov. 12, 1888 Daley, Chas., *Knowsley-buildings.*

Nov. 28, 1881 Danger, William, *Orange-court, Castle-street*, and *Liscard Park, Liscard.*

Nov. 12, 1866 Davies, E., F.C.S., F.I.C., The Laboratory, Royal Institution, *Colquitt-street*, PRESIDENT.

Dec. 10, 1888 Davey, Wm. J. (Messrs. Elder, Dempster & Co.), *Castle-street*, and 24, *Brompton-avenue.*

Oct. 1, 1866 Dawson, Thomas, 26, *Rodney-street.*

April 6, 1874 Dodd, John, *Cable-street*, and 2, *Derby-terrace, Rock Ferry.*

Nov. 3, 1879 Dopson, Daniel, L.D.S., R.C.S.I., 4, *Oxford-street.*

Jan. 22, 1883 Dowling, Jas. (P. S. Levy), 24, *North John-street.*

Nov. 1, 1875 Doyle, Jas. F., 4, *Harrington-street*, and *Merton-road, Bootle.*

Jan. 28, 1848 Drysdale, John James, M.D. Edin., M.R.C.S. Edin., 36, *Rodney-street*, EX-PRESIDENT.

*Nov. 27, 1848 Edwards, J. B., Ph.D. Gies., F.C.S., Professor Medical Faculty of Bishop's College, *Montreal.*

March 21, 1870 Edwards, Edward E. (Smith, Edwards & Co.), *Adelaide-buildings*, 4, *Chapel-street.*

Oct. 15, 1888 Edwards, Frederick Wilkinson, 2, *Canada Dock*, and *Fairhope, Victoria Park, Walton.*

April 7, 1862 English, Charles J., 26, *Chapel-street*, and 26, *Falkner-square.*

Nov. 14, 1881 Evans, Geo. Eyre, 100, *Camden-street, Birkenhead.*

*Dec. 18, 1852 Ferguson, William, F.L.S., F.G.S., *Kinmundy House, near Mintlaw, N.B.*

Nov. 15, 1875 Fleming, E. L., F.C.S., *Borax Works, Old Swan.*
Oct. 1, 1866 Fletcher, Alfred E., F.C.S., H.M. Inspector of Alkali Works for the Western District, 5, *Edge-lane.*
*Mar. 19, 1855 Foard, James Thomas, 4, *St. James's-square, Manchester.*
Jan. 12, 1874 Frost, John Pownall, 10, *North John-street.*
Nov. 12, 1877 Galley, Jno., 8, *Newstead-road.*
Nov. 13, 1882 Gardner, Willoughby, 18c, *Exchange-buildings.*
*Feb. 6, 1854 Gee, Robert, M.D. Heidelb., M.R.C.P., Lecturer on Diseases of Children, Royal Infirmary School of Medicine; Physician Workhouse Hospital, 5, *Abercromby-square.*
Nov. 26, 1883 Gibson, R. J. Harvey, M.A., 65, *Grove-street.*
March 20, 1882 Gill, James, *Sailors' Home,* and 2, *Beech-mount, Beech-street.*
Oct. 20, 1879 Gracey, Robert, F.C.S. (Messrs. Gracey Bros. & Co.), 70, *Great George-street.*
Oct. 29, 1877 Green, Robt. Frederick, 66, *Whitechapel.*
Oct. 29, 1883 Green, Chas. H. (Messrs. Green, Hill & Co.), *Lydia Anne-street.*
Nov. 14, 1858 Greenwood, Henry, 32, *Castle-street,* and *South Lawn, Great George's-road, Waterloo.*
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Oct. 29, 1883 Guthrie, Mrs., 2, *Parkfield-road.*
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*Jan. 21, 1856 Hardman, Lawrence, 35, *Rock Park, Rock Ferry.*
Dec. 10, 1883 Hargreaves, Jas., F.C.S., F.A.S., *Peel House-lane, Farnworth-by-Widnes.*
Dec. 13, 1875 Harpin, E., 46, *Onslow-road, Elm Park, Fairfield.*
Nov. 30, 1874 Harvey, Henry, M.B., *High-street, Wavertree.*
Feb. 6, 1865 Hassan, Rev. E., 2, *Olive Mount, Wavertree.*
Nov. 13, 1865 Hayward, John Williams, M.D., 117, *Grove-street.*

Dec. 10, 1888 Heath, Miss Alice, 10, *Kelvin Grove.*

Feb. 6, 1865 Hebson, Douglas, 18, *Tower-chambers*, and 58, *Bedford-street South.*

Oct. 16, 1882 Herdman, W. A., D.Sc., F.L.S., F.R.S.E., Professor of Natural History, University College, 99, *Bedford-street.*

March 7, 1880 Hess, Leonard O., 51, *Bedford-street.*

Nov. 4, 1872 Hicks, John Sibley, F.R.C.S., F.L.S., 2, *Erskine-street.*

March 22, 1869 Higgin, Thomas, F.L.S., 38, *Tower-buildings*, and *Huyton*, Vice-President.

Dec. 28, 1846 Higgins, Rev. H. H., M.A. Cantab., F.C.P.S., *Rainhill*, Ex-President.

Jan. 18, 1879 Higgins, Henry Longuet (Messrs. Simpson & North), 8, *Water-street.*

Feb. 18, 1878 Hilton, Benjamin H., Crown Life Assurance, 5B, *Exchange-buildings.*

Nov. 16, 1863 Holden, Adam, 48, *Church-street*, and 2, *Carlton-terrace, Milton-road.*

March 9, 1868 Holme, James, 10, *Huskisson-street*, and *Eldon-chambers, South John-street.*

Nov. 30, 1874 Holme, Rev. Arthur P., *Tattenhall, near Chester.*

*Dec. 14, 1862 Holt, Robert Durning, 6, *India-buildings*, and 29, *Edge-lane.*

April 9, 1877 Hooper, Richard Bennett, 6, *Loudon Grove, Huntington-street, North Hill-street.*

Jan. 21, 1884 Hope, E. W., M.D., 35, *Bedford-street.*

Nov. 4, 1878 Howie, J. Muir, M.B., 86, *Prince's-road.*

March 10, 1879 Hughes, John W., *Hornby-road, Wavertree.*

Jan. 24, 1876 Hughes, Lewis, *Tan-y-Bryn, Conway*, and *Fenwick Court.*

Feb. 20, 1882 Hunter, Hugh, 25A, *Duke-street.*

*Nov. 18, 1854 Hunter, John, Member Historic Society, Pennsylvania, *Halifax, Nova Scotia.*

*April 29, 1850 Ihne, William, Ph.D.Bonn, *Villa Felseck, Heidelberg*, Ex-President.

Oct. 19, 1874 Imlach, Francis, M.D., 16, *Canning-street.*

Nov. 26, 1888 Ismay, Joseph, Telegraph Department, *General Post Office, Liverpool.*

Jan. 26, 1868 Johnson, Richard C., F.R.A.S., 22, *Queen-buildings, Dale-street*, and 19, *Catherine-street.*

Feb. 24, 1868 Jones, Charles W., *Field House, Wavertree.*

*April 4, 1852 Jones, Morris Charles, F.S.A., F.S.A.Scot., *Gungrog, Welshpool.*

Nov. 1, 1869 Kinsman, W. N., *The Tower, Sandfield Park.*

Oct. 21, 1844 Lear, John, *Stoneby Cottage, Stoneby Green, New Brighton.*

Nov. 8, 1878 Lee, Hamilton (Messrs. Lee & Nightingale), *North John-street.*

*Dec. 11, 1871 Leigh, Richmond, M.R.C.S., L.S.A., Physician to St. George's Hospital for Diseases of the Skin, 15, *St. James's-road*, HON. LIBRARIAN.

Nov. 18, 1882 Levy, Philip S., 24, *North John-street.*

Nov. 14, 1881 Lloyd, Richard J., B.A., *Lombard-chambers, Bixteth-street.*

Oct. 31, 1881 Lodge, Oliver J., D.Sc., Professor of Physics, University College, 26, *Waverley-road, Sefton Park.*

Dec. 1, 1879 Long, Rev. R. E., *Cambridge House, Upper Parliament-street.*

Feb. 7, 1881 Lovell, John, 17, *Gambier-terrace*, and "Mercury" Office, *Wood-street.*

Oct. 2, 1882 MacCunn, John, M. A., Professor of Philosophy and Political Economy, University College, *Ashton-street.*

Oct. 15, 1888 Macgregor, Miss Jessie, 158, *Bedford-street*, and *Elm Tree Studio, Elm Tree-road, St. John's Wood, London.*

Jan. 23, 1882 Marcus, Heinrich, *Trafford-chambers*, 58, *South John-street.*

Nov. 14, 1870 Marples, Joseph, 28, *Leece-street*, and *Carlton-road, Tranmere.*

Nov. 17, 1878 Marples, Josiah, *Melvill-chambers*, *Lord-street*, and *Broomfield*, *Egremont*.

Feb. 19, 1877 Marples, William, 8, *Mathew-street*, and *Alfred-road*, *Birkenhead*.

Jan. 21, 1889 Martin, Studley, 27, *Brown's-buildings*, and 177, *Bedford-street South*.

Oct. 20, 1879 McArthur, Charles, 18F, *Exchange-buildings*.

March 28, 1874 McCulloch, D. B., 28, *Queen-buildings*, *Dale-street*.

Nov. 18, 1882 McKenzie, Rev. John Monroe, 5, *Canning-street*.

Oct. 17, 1881 McLintock, R., 8, *Balmoral-road*.

Oct. 30, 1882 McMaster, John Maxwell (Messrs. J. B. Wilson, Dean & McMaster), 22A, *Lord-street*.

Oct. 15, 1888 Mead, A. J., Grammar School, *Wallasey*.

Nov. 17, 1878 Mellor, James, Jun., *Weston*, *Blundellsands*.

Dec. 14, 1874 Mellor, John, *Stansty*, *Waterloo Park*, *Waterloo*.

Oct. 20, 1879 Mellor, Thomas, *Edgewater*, *Blundellsands*.

Oct. 31, 1859 Moore, Thomas John, Corr. Mem. Z.S.L., Curator Free Public Museum, *William Brown-street*, VICE-PRESIDENT.

Nov. 1, 1880 Morrow, John, *Lynwood*, *Priory-road*, *Broad Green*.

March 6, 1882 Morton, Geo. Henry, 122, *London-road*.

Jan. 8, 1855 Morton, Geo. Highfield, F.G.S., 122, *London-road*.

April 16, 1849 Moss, Rev. John James, B.A., *East Lydford Hall*, *Somerton*, *Somerset*.

Oct. 29, 1850 Mott, Albert Julius, F.G.S., *Crickley Hill*, *Gloucester*, EX-PRESIDENT.

April 8, 1854 Mott, Charles Grey, *Harrow Weald Lodge*, *Middlesex*.

Oct. 31, 1881 Mount, Ed., *Brown-hill*, *Lydiate*, *Ormskirk*.

Dec. 16, 1878 Murphy, Rev. P., *Seaforth*.

*Oct. 21, 1867 Muspratt, E. K., *Seaforth Hall*, *Seaforth*.

Oct. 20, 1856 Nevins, John Birkbeck, M.D.Lond., M.R.C.S., Late Lecturer on Materia Medica, Royal Infirmary School of Medicine, 3, *Abercromby-square*, Ex-President.

Feb. 6, 1865 Newton, John, M.R.C.S., 20, *Marmaduke-street, Edgehill.*

Jan. 21, 1884 Nicholson, Edward, F.C.S., F.I.C., Surgeon-Major Army Retired, 73, *Bedford-street.*

Feb. 18, 1878 Nicholson, Robert, 11, *Harrington-street.*

Nov. 2, 1868 Norrie, Rev. B. A. W., M.A. Cantab, The College School, *Huyton.*

*Oct. 15, 1855 North, Alfred, 1, *Hanover-terrace, Notting-hill, London, W.*

Dec. 18, 1866 Owen, Peter (Farnworth & Jardine), *Liverpool and London Chambers.*

Nov. 2, 1874 Palmer, John Linton, F.S.A., F.R.G.S., Fleet Surgeon, R.N., 24, *Rock Park, Rock Ferry.*

Nov. 28, 1881 Parkyn, Jas., *Beaconsfield, Rake-lane, Liscard.*

Nov. 13, 1882 Paton, Rev. William, *Mossgill House, New Ferry.*

Jan. 9, 1871 Patterson, J., 16, *Devonshire-road, Prince's Park.*

Nov. 4, 1861 Philip, Thomas D., 49, *South Castle-street*, and *Holly-road, Fairfield.*

Dec. 28, 1846 Picton, Sir James Allanson, F.S.A., Chairman of the Library and Museum Committee, 11, *Dale-street*, and *Sandy Knowe, Wavertree*, Ex-President.

Nov. 1, 1875 Picton, William Henry, *Woodlea, Waterloo Park, Waterloo.*

Feb. 24, 1879 Plastow, William, 333, *Scotland-road.*

Jan. 21, 1884 Polack, Rev. J., B.A., 88, *Falkner-street.*

*Jan. 22, 1866 Raffles, William Winter, 23, *Linden Gardens, London, W.*, and *Glan-y-mor, Penmaenmawr.*

Nov. 12, 1860 Rathbone, Philip H., *Greenbank Cottage, Wavertree.*

March 24, 1862 Rathbone, Richard Reynolds, 17, *Lancaster-buildings, Tithebarn-street*, and *Beechwood House, Grassendale.*

Jan. 7, 1878 Read, Robert, 28, *Berkeley-street.*

*Nov. 17, 1851 Redish, Joseph Carter, Lyceum, *Bold-street.*

Oct. 31, 1881 Rendall, G. H., M.A., Principal of University College, 70, *Bedford-street.*

Oct. 31, 1881 Rennie, J. W., 54, *Foxhill-street.*

Nov. 29, 1869 Roberts, Isaac, F.G.S., *Kennessee, Maghull.*

Dec. 4, 1876 Roberts, Richard (Messrs. Roberts & Son), 18, *Hackins-hey* and *Mossley-hill.*

Oct. 4, 1869 Rogers, J. Frederick, 7, *Victoria-street*, and 22, *Ullet-road, Prince's Park.*

Jan. 10, 1876 Rogerson, George Russell, F.R.A.S., F.R.G.S., F.R.S.L., *Cook-street* and *Allerton.*

Oct. 21, 1878 Roose, Edward B., 26, *North John-street.*

Nov. 13, 1882 Rose, Frederick, L.D.S.Eng., 64, *Mount-pleasant.*

Oct. 29, 1877 Rosenheim, Jos. C., *Sunny Bank, Prince's Park.*

April 18, 1854 Rowe, James, 14, *South Castle-street*, and *Leyfield Grange, West Derby.*

Jan. 22, 1872 Russell, Edward R., "Daily Post" Office, *Victoria-street*, and 6, *Abercromby-square*, Ex-President.

Feb. 18, 1878 Russell, W., Compton Hotel, *Church-street.*

Feb. 18, 1884 Rutherford, John, LL.B. Lond., 15, *Stephenson-chambers*, 25, *Lord-street.*

Nov. 12, 1888 Rutherford, Wm. Watson (Messrs. Miller, Peel, Hughes & Co.), *Eberle-street.*

April 7, 1862 Samuel, Harry S., 69, *Onslow Gardens, South Kensington, London.*

Nov. 29, 1880 Sang, Walter, 8, *Brompton Avenue, Sefton Park.*

Oct. 18, 1880 Schack-Sommer, Dr. (Messrs. Crossfield, Barrow & Co.), 323, *Vauxhall-road.*

March 19, 1883 Selwyn, Rev. E. C., M.A., The College, *Shaw-street.*

March 19, 1866 Sephton, Rev. John, M.A., *Liverpool Institute.*

Oct. 15, 1883 Sephton, Mrs., 90, *Huskisson-street.*
Dec. 2, 1878 Serjeant, Jno., 128, *London-road.*
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Jan. 7, 1884 Sharp, W. E., 6, *Colonial-chambers*, and *Stoneleigh Cottage, Birch-road, Bebington.*
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Dec. 10, 1866 Smith, Elisha (Messrs. Henry Nash & Co.), 12, *Tower-buildings North.*
April 4, 1870 Smith, James, 9, *Lord-street*, and *Ribblesdale Villas*, 22, *Merton-road, Bootle.*
Feb. 28, 1868 Smith, J. Simm, 1, *Warham-road, Croydon.*
Feb. 24, 1862 Snape, Joseph, Lecturer on Dental Surgery, Royal Infirmary School of Medicine, 13, *Scarisbrick-street, Southport.*
April 20, 1874 Snow, Rev. T., M.A., 12, *St. Paul's-square.*
Oct. 15, 1883 Somervell, R., The College, *Shaw-street.*
Nov. 12, 1860 Spence, Charles, 4, *Oldhall-street.*
Feb. 10, 1862 Spence, James, 18, *Brown's-buildings, Exchange*, and 10, *Abercromby-square.*
Jan. 13, 1868 Stearn, C. H., *Selwood, Mayon-road, Forest-hill, London.*
Nov. 12, 1883 Steel, James, J. P., 16, *Abercromby-square.*
Nov. 18, 1878 Steel, Richard, PRESIDENT, 18, *Hackins-hey.*
Feb. 19, 1883 Steeves, Gilbert M., 24, *Falkner-street.*
Nov. 13, 1876 Stephens, Thomas English, *Seafield, Victoria-road, New Brighton.*
Oct. 24, 1876 Stern, Rev. William, Ph.D., 3, *Hope-place.*
Nov. 1, 1875 Stevenson, John, *Prince Alfred-road, Wavertree.*

Jan. 9, 1865 Stewart, Robert E., L.D.S., R.C.S., 37, *Rodney-street.*
Oct. 29, 1883 Stretch, Wm. Knowles, 29, *Balmoral-road, Fairfield.*
Nov. 28, 1881 Sumner, R. M., 50A, *Lord-street.*
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Feb. 18, 1878 Symes, Charles, Ph.D., *Park Way House, Park Way, Upper Parliament-street.*
April 17, 1882 Tapscott, W. W., 89, *Oldhall-street,* and 41, *Parkfield-road, Aigburth.*
Jan. 23, 1882 Tate, George, Ph.D., F.G.S., F.C.S., Liverpool College of Chemistry, *Duke-street.*
Feb. 18, 1878 Taylor, Geo., 28, *Seel-street.*
*Feb. 19, 1865 Taylor, John Stopford, M.D. Aberd., F.R.G.S., *Rivelin, Richmond Park, Anfield-road.*
Nov. 29, 1875 Tetley, John H., *Sunnyside,* 21, *Rock Park, Rock Ferry.*
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Nov. 17, 1850 Tinling, Chas., *Victoria-street,* and 29, *Onslow-road, Elm Park.*
Nov. 27, 1882 Tobias, Henry A., 18, *Hackins-hey.*
Dec. 4, 1876 Torpy, Rev. Lorenzo, M.A., *Setubal.*
*Feb. 19, 1844 Turnbull, James Muter, M.D. Edin., M.R.C.P., 86, *Rodney-street.*
Oct. 21, 1861 Unwin, William Andrew, 11, *Rumford-place.*
Oct, 20, 1879 Veevers, Samuel, *Huyton,* and 12A, *Manchester-buildings, Tithebarn-street.*
Nov. 15, 1880 Vicars, John, 29, *Seel-street.*
Feb. 24, 1879 Walker, R. S., J.P., Resident Secretary, General Insurance Co., 3, *Brunswick-street.*
Feb. 19, 1877 Wallace, John, M.D., *Gambier-terrace.*
Jan. 27, 1862 Walmsley, Gilbert G., 50, *Lord-street.*

Jan. 9, 1865 Walthew, William, *Phœnix Chambers*, and *Vine Cottage, Aughton.*

March 4, 1872 Ward, Thomas, *Brookfield House, Northwich.*

Oct. 30, 1876 Weightman, Arthur (Messrs. Field & Weightman), *Talbot Chambers*, 3, *Fenwick-street, W.*

Nov. 13, 1882 Weightman, William, 17, *Park Way.*

April 7, 1862 Whittle, Ewing, M.D., Lecturer on Medical Jurisprudence, Royal Infirmary School of Medicine, 77A, *Upper Parliament-street.*

Dec. 2, 1861 Wightman, William Henry, *Minster-buildings, Church-street*, and *Camidge-road, Seaforth.*

Jan. 7, 1884 Williams, J. M. (Messrs. A. Bower & Son), *Brown's-buildings.*

Oct. 31, 1881 Williams, Richard, M.D., 82, *Rodney-street.*

Nov. 14, 1881 Williams, Rev. S. Fletcher, *Birmingham.*

Nov. 2, 1874 Wolf, Jas. O. de (Messrs. T. C. Jones & Co.) 26, *Chapel-street.*

Nov. 14, 1870 Wood, John J. (Messrs. Abraham & Co.), 20, *Lord-street.*

Nov. 29, 1875 Yates, D. E., 26, *Castle-street*, and 38, *Huskisson-street.*

Nov. 13, 1876 Yates, Edward Wilson, 37, *Castle-street.*

Nov. 2, 1874 Young, Henry, *South Castle-street.*

Oct. 30, 1882 Zicaliotti, Alexander, 60, *Cable-street*, and 7, *Grove Park.*

HONORARY MEMBERS

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1.—1836 The Most Noble William, Duke of Devonshire, K.G., M.A., F.R.S., D.C.L., F.G.S., etc., Chancellor of the University of Cambridge, *Chatsworth, Derbyshire*, and 78, *Piccadilly, London, W.*

2.—1838 Sir George Biddell Airy, K.C.B., M.A., LL.D., D.C.L., F.R.S., F.R.A.S., etc., Royal Observatory, *Greenwich.*

3.—1840 James Nasymth, F.R.S., *Penshurst, Kent.*

4.—1844 T. B. Hall, *Crane House, Yarmouth.*

5.—1844 Peter Rylands, M.P., *Warrington.*

6.—1844 William B. Carpenter, M.D., F.R.S., F.L.S., Corresponding Member of the Institute of France, etc., *London.*

7.—1850 The Rev. Canon St. Vincent Beechy, M.A., Rector of Hilgay, *Norfolk.*

8.—1851 The Rev. Robert Bickersteth Mayor, B.D., Rector of Frating, *Essex.*

9.—1857 Thomas Joseph B. Hutchinson, F.R.G.S., F.R.S.L., F.E.S., *Ballinescar Lodge, Curracloe, co. Wexford.*

10.—1861 The Rev. Thomas P. Kirkman, M.A., F.R.S., Rector of Croft, *near Warrington.*

11.—1865 The Right Rev. T. N. Staley, D.D., late Bishop of Honolulu, Vicar of Croxhall, *Staffordshire.*

12.—1865 Sir Edward J. Reed, K.C.B., F.R.S., M.P., *Hextable, Dartford, Kent.*

13.—1865 Cuthbert Collingwood, M.A., M.B., F.L.S., 4, *Grove-terrace, Belvedere-road, Upper Norwood, London, S.E.*

14.—1867 Sir J. W. Dawson, LL.D., F.R.S., etc., Principal and Vice-Chancellor of McGill University, *Montreal.*

15.—1868 Captain Sir James Anderson, 16, *Warrington-crescent, Maida Hill, London, W.*

16.—1870 Sir John Lubbock, Bart, M.P., F.R.S., etc., *High Elms, Farnborough, Kent.*

17.—1870 Professor Henry E. Roscoe, F.R.S., etc., Owens College, *Manchester.*

18.—1870 Sir Joseph Dalton Hooker, M.D., F.R.S., etc., *Kew.*

19.—1870 Professor Brown Sequard, M.D.

20.—1870 John Gwyn Jeffreys, F.R.S., *Ware Priory, Herts.*

21.—1870 Professor Thomas H. Huxley, LL.D., F.R.S., etc., 4, *Marlborough-place, London, N.W.*

22.—1870 Professor John Tyndall, LL.D., F.R.S., etc., Royal Institution, *London.*

23.—1870 The Rev. Christian D. Ginsburg, LL.D., *Binfield, Bracknell, Berks.*

24.—1874 Professor Alexander Agassiz, Director of the Museum of Comparative Zoology, *Harvard, Cambridge, Massachusetts.*

25.—1874 Professor Frederick H. Max Müller, LL.D., *Oxford.*

26.—1874 Sir Samuel White Baker, Pasha, F.R.S., F.R.G.S., etc., *Sandford Orleigh, Newton Abbot, Devonshire.*

27.—1877 Professor F. V. Hayden, M.D., etc., Director of the United States Geological and Geographical Survey of the Territories, *Washington.*

28.—1877 The Earl of Crawford and Balcarres, F.R.S., Foreign Secretary of R.A.S., etc., 9, *Grosvenor-square, London.*

29.—1877 Albert C. N. Günther, M.A., M.D., Ph.D., British Museum.

30.—1877 Adolphus Ernst, M.D., Principal of the Department of Science, Philosophy, and Medicine, University of Caracas.

31.—1877 Dr. Leidy, Academy of Science, *Philadelphia.*

82.—1877 Dr. Franz Steindachner, Royal and Imperial Museum, *Vienna.*

83.—1877 The Rev. H. B. Tristram, M.A., LL.D., F.R.S., Canon of Durham, The College, *Durham.*

84.—1880 Joseph Mayer, F.S.A., *Pennant House, Bebington.*

85.—1881 H. J. Carter, F.R.S., *The Cottage, Budleigh, Salterton, Devon.*

86.—1881 The Rev. Thomas Hincks, B.A., F.R.S., *Stokeleigh, Leigh Woods, Clifton, Bristol.*

87.—1881 The Rev. W. H. Dallinger, LL.D., F.R.S., Wesley College, *Sheffield.*

CORRESPONDING MEMBERS.

LIMITED TO THIRTY-FIVE.

1.—1867 J. Yate Johnson, *London.*

2.—1867 R. B. N. Walker, F.R.G.S., F.G.S., *West Africa.*

3.—1868 Rev. J. Holding, M.A., F.R.G.S., *London.*

4.—1868 George Hawkins, *Colombo, Ceylon.*

5.—1868 J. Lewis Ingram, *Bathurst, River Gambia.*

6.—1869 George Mackenzie, *Cebu, Philippine Islands.*

7.—1870 Rev. Joshua Hughes-Games, D.C.L., King William's College, *Isle of Man.*

8.—1874 Samuel Archer, Surgeon-Major, *Singapore.*

9.—1874 Coote M. Chambers, *Burrard's Inlet, British Columbia.*

10.—1874 Edwyn C. Reed, *Santiago de Chili.*

11.—1874 Millen Coughtrey, M.D., *Dunedin, Otago, New Zealand.*

12.—1875 Robert Gordon, Government Engineer, *British Burmah.*

13.—1877 Edward Dukinfield Jones, C.E., *Sao Paulo, Brazil.*

14.—1877 Miss Horatio K. F. Gatty, *Ecclesfield Vicarage, Wakefield.*

15.—1877 Dr. Allen, *Jamaica.*

16.—1877 Dr. George Bennett, *Sydney.*

17.—1877 Dr. David Walker, *Benicia, U.S.A.*
18.—1884 Rev. W. G. Lawes, *New Guinea.*
19.—1884 A. W. Crawford, *Oakland, California.*
20.—1884 John Greenwood, Mining Engineer, *Melbourne.*
21.—1884 Robert Abraham English, *Simla.*

ASSOCIATES.

LIMITED TO TWENTY-FIVE.

1.—Jan. 27, 1862 Captain John H. Mortimer, "America." (Atlantic.)
2.—Mar. 24, 1862 Captain P. C. Petrie, "City of London," Commodore of the Inman Line of American Steam Packets. (Atlantic.)
3.—Feb. 9, 1863 Captain James P. Anderson, Cunard Service. (Atlantic.)
4.—Feb. 9, 1863 Captain John Carr (Bushby & Edwards), ship "Scindia." (Calcutta.)
5.—Feb. 9, 1863 Captain Charles E. Price, R.N.R. (L. Young & Co.), ship "Cornwallis." (Calcutta and Sydney.)
6.—April 20, 1863 Captain Fred. E. Baker, ship "Niphon." (Chinese Seas.)
7.—Oct. 31, 1864 Captain Thomson, ship "Admiral Lyons." (Bombay.)
8.—April 13, 1865 Captain Alexander Cameron (Boult, English & Brandon), ship "Staffordshire." (Shanghai.)
9.—Dec. 11, 1865 Captain Walker, ship "Trenton."
10.—Mar. 23, 1868 Captain David Scott.
11.—Oct. 5, 1868 Captain W. H. Cawne Warren, ship "Bedfordshire."
12.—April 7, 1884 Captain G. Griffith Jones, barque "Hermine."

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A.

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D.

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E.

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F.

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H.

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SOCIETIES, ACADEMIES, AND OTHER INSTITUTIONS,

TO WHICH THIS VOLUME IS PRESENTED.

(*Donations received this Session from those prefixed with an Asterisk.*)

Great Britain and Ireland.

Aberdeen - - - -	The Dun-Echt Observatory.
Alnwick - - - -	*The Berwickshire Naturalists' Field Club.
Bath - - - - -	*The Natural History and Antiquarian Field Club.
Belfast - - - -	*The Naturalists' Field Club.
Belfast - - - -	*The Natural History and Philosophical Society.
Birkenhead - - -	The Free Public Library.
Birkenhead - - -	*The Literary and Scientific Society.
Birmingham - - .	*The Philosophical Society.
Bristol - - - -	*The Naturalists' Society.
Buckhurst Hill - -	*The Epping Forest Naturalists' Field Club.
Chester - - - - -	The Society of Natural Science.
Cambridge - - -	The Cambridge Union.
Dublin - - - - -	*The Royal Irish Academy.
Dublin - - - - -	*The Royal Geological Society of Ireland.
Dublin - - - - -	*The Royal Society.
Edinburgh - - -	*The Botanical Society.
Edinburgh - - -	*The Geological Society.
Edinburgh - - -	*The Meteorological Society of Scotland.
Edinburgh - - -	The Philosophical Institution.
Edinburgh - - -	The Royal Observatory.
Edinburgh - - -	*The Royal Physical Society.

Edinburgh - - -	*The Royal Scottish Society of Arts.
Edinburgh - - -	The Royal Society.
Falmouth - - -	*The Royal Cornwall Polytechnic Society.
Glasgow - - - -	*The Philosophical Society.
Glasgow - - - -	*The Geological Society.
Glasgow - - - -	*The University.
Greenwich - - -	*The Royal Observatory.
Halifax - - - -	The Literary and Philosophical Society.
Hull - - - - -	The Literary and Philosophical Society.
London - - - -	*The Anthropological Institute.
London - - - -	*The Society of Antiquaries.
London - - - -	*The Royal Institute of British Architects.
London - - - -	*The Society of Arts.
London - - - -	*The Royal Asiatic Society.
London - - - -	*The Royal Astronomical Society.
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London - - - -	*The British Museum.
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London - - - -	*The Zoological Society.
London - - - -	*The Editor of "Nature."
London - - - -	*The Editor of "The Journal of Science."
London - - - -	*The Editor of "Science Gossip."

London - - - -	*The Editor of "The Scientific Roll."
Leeds - - - - -	The Philosophical and Literary Society.
Leeds - - - - -	The Yorkshire Geological and Polytechnic Society.
Leicester - - - -	The Literary and Philosophical Society.
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Liverpool - - - -	The Engineering Society.
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Liverpool - - - -	*The Geological Association.
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Liverpool - - - -	The Athenæum Library and News Room.
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Liverpool - - - -	The Medical Institution.
Liverpool - - - -	The Royal Institution.
Liverpool - - - -	University College.
Manchester - - -	The Literary Club.
Manchester - - -	The Literary and Philosophical Society.
Manchester - - -	Chetham Library.
Manchester - - -	The Free Public Library.
Manchester - - -	Owens College.
Newcastle-on-Tyne -	The Natural History Society of Northumberland and Durham.
Oxford - - - -	The Ashmolean Society.
Oxford - - - -	The Union Society.
Penzance - - - -	*The Royal Geological Society of Cornwall.
Plymouth - - -	*The Plymouth Institution.
Taunton - - - -	The Somersetshire Archæological Society.
Truro - - - - -	*The Royal Institution of Cornwall.

Watford - - - - The Hertfordshire Natural History Society and Field Club.

Welshpool - - - *The Powys Land Club.

Whitby - - - - *The Literary and Philosophical Society.

BRITISH COLONIES AND THE UNITED STATES.

Bombay - - - - *The Royal Asiatic Society.

Boston - - - - *The American Academy of Arts and Science.

Boston - - - - The Massachusetts Board of Education.

Boston - - - - *The Massachusetts Board of Health, Lunacy, and Charity.

Boston - - - - *The Natural History Society.

Boston - - - - The Public Library.

Buffalo - - - - *The Society of Natural Sciences.

Calcutta - - - - *The Asiatic Society of Bengal.

Calcutta - - - - *The Geological Survey of India.

Cambridge (*Mass.*) - *Harvard University.

Cambridge (*Mass.*) - *Museum of Comparative Zoology.

Cambridge (*Mass.*) - *The Peabody Museum of American Archæology and Ethnology.

Chicago - - - - The Public Library.

Davenport - - - *The Academy of Natural Sciences.

Melbourne - - - *The Royal Society of Victoria.

New Haven - - - The Connecticut Academy of Arts and Sciences.

New York - - - *The Academy of Sciences.

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New York - - - *The American Geographical Society.

New York - - - The City University.

New York - - - *The State University.

New York - - - *The State Library.

New York - - - The American Museum of Natural History.

Otago - - - - - The University.

Ottawa - - - - *Geological and Natural History Survey.

Ottawa - - - - The Library of Parliament.
Philadelphia - - - *The Academy of Natural Sciences.
Philadelphia - - - *The American Philosophical Society.
Philadelphia - - - *The Franklin Institute.
Philadelphia - - - The Pennsylvania Board of Public Education.
Philadelphia - - - *The Zoological Society.
Salem - - - - - *The American Association for the Advancement of Science.
Salem - - - - - The Essex Institute.
San Francisco - - The Lick Observatory.
Sydney - - - - The Royal Society of New South Wales.
Sydney - - - - *The Department of Mines.
Toronto - - - - *The Canadian Institute.
Washington - - - The Department of Agriculture.
Washington - - - The Geological and Geographical Survey of the Territories.
Washington - - - *The Naval Observatory.
Washington - - - *The Smithsonian Institution.
Washington - - - *The Department of Ordnance; * the Department of the Chief of Engineers; * the Department of Agriculture; * the Department of the Interior.
Wellington - - - *The New Zealand Institute.

FOREIGN.

Amsterdam - - - *L'Académie Royale des Sciences.
Berlin - - - - *Der Akademie der Wissenschaften.
Bordeaux - - - *La Société des Sciences Physiques et Naturelles,
Brussels - : - - *L'Académie Royale des Sciences, des Lettres, et des Beaux-Arts de Belgique.
Cherbourg - - - La Société Nationale des Sciences Naturelles.
Christiania - - - *The University.

Copenhagen - - - *L'Académie Royale.
Copenhagen - - - *La Société Royale des Antiquaires du Nord.
Geneva - - - - La Société de Physique et d'Histoire Naturelle.
Gottingen - - - Der Königlichen Gesellschaft der Wissenschaften.
Grieswald - - - The University.
Harlem - - - - *La Société Hollandaise des Sciences.
Helsingfors - - - *La Société des Sciences de Finlande.
Königsberg - - - Der Königlichen Physikalisch-ökonomischen Gesellschaft.
Milan - - - - *La Reale Instituto Lombardo.
Munich - - - - *Der Königlichen Akademie der Wissenschaften.
Paris - - - - - *L'Ecole Polytechnique.
Presburg - - - - Vereins fur Natur und Heil-Kunde.
St. Petersburg - - *L'Académie Imperiale des Sciences.
Stockholm - - - L'Académie Royal Suedoise des Sciences.
Strasburg - - - - La Bibliothèque Municipale.
Strasburg - - - - Der Kaiserliche Universitäts und Landes-Bibliothek.
Tokio - - - - - The University.
Toulouse - - - - L'Observatoire Astronomique.
Vienna - - - - - *Der Kaiserliche Akademie der Wissenschaften.
Vienna - - - - - *Der Geographischen Gesellschaft.

TREASURER'S ACCOUNT, 1882–83.

Dr. *The* LITERARY AND PHILOSOPHICAL SOCIETY, *in Account with* R. C. JOHNSON, *Treasurer.* **Cr.**

1882–83.	£	s.	d.
To Cash paid D. Marples & Co. Limited (Printing Volume)	147	16	9
" " Tinling & Co. (Printing Circulars)	10	12	0
" " Secretary's Expenses	17	0	6
" " Editorial Fee	10	10	0
" " Treasurer's Expenses	0	15	4
" " Doling (Refreshments)	32	9	6
" " S. Burke (Attendance)	1	15	0
" " Royal Institution (Rent)	20	0	0
" Dock Bond in hand	150	0	0
	£390	19	1
To Balance brought down	£6	10	1

1882–83.				£	s.	d.
By Balance from last account:—						
Dock Bond	£150	0	0			
Cash	18	18	8			
				168	18	8
" Cash from Subscriptions:—						
18 Entrance Fees, at 10s. 6d.	£9	9	0			
181 Annual Subscriptions, at 21s.	190	1	0			
9 Arrears	9	9	0			
				208	19	0
Interest on Dock Bond				6	11	4
Balance due to Treasurer				6	10	1
				£390	19	1

Examined and found correct,

(*Signed*), ISAAC ROBERTS.

MALCOLM GUTHRIE.

PROCEEDINGS

OF THE

LIVERPOOL LITERARY AND PHILOSOPHICAL SOCEITY.

ANNUAL MEETING.—SEVENTY-THIRD SESSION.

ROYAL INSTITUTION, October 1st, 1883.

EDWARD DAVIES, F.C.S., F.I.C., PRESIDENT, in the Chair.

THE Minutes of the last Meeting of the previous session were read and confirmed.

The Honorary Secretary read the following

REPORT.

The seventy-second Session of the Literary and Philosophical Society has been one of considerable activity; the meetings have been largely attended, and the members have been assiduous to maintain the Society's intellectual vigour.

The numerous Papers which have been read have excited much interest, and have induced animated discussions; and while all of them have in this way proved beneficial to the Society, it should be noted that some are of exceptional value, and have added to the sum of human knowledge.

Our active corresponding member, Mr. Dukinfield Jones, has communicated an account of his further observations of the ways and habits of the Lepidoptera of Brazil; and a report by Professor Herdman on the "Phosphorescence of Milky Sea" is a valuable epitome of what is so far known of that curious phenomenon.

The much debated subject of Thought Reading, or Thought Transference, has been brought under discussion in a short Paper by the Rev. H. H. Higgins, and also in a subsequent report of some experiments thereon by Mr. Guthrie. Neither the Council nor the Society commits itself to any opinion on this matter; but whatever may be the present scientific worth of such experiments the record of them will possibly be of some service in future investigations.

The Session has been marked by some alterations in the Laws.

The old edition of the Laws being exhausted, it was considered advisable to revise them throughout, previous to their being reprinted. Advantage was taken of this opportunity to settle the question of Lady-membership, which had from time to time been discussed in the Society, and a new law was added declaring that "Ladies are eligible to become members, with the same duties and privileges as other members."

It was a gratifying coincidence with this change that the first contribution to the Society's *Proceedings* by a lady, was read to the members. This Paper was communicated by Miss Heath, of University College, Liverpool, and is descriptive of her original researches in the "Structure of the Polycarp and the Endocarp in the Tunicata."

The financial condition of the Society continues to be satisfactory. The number of Ordinary Members remains at the same figure as last year, namely 258—nineteen members having replaced as many who have resigned.

The number of Honorary Members is 38; of the corresponding members 17; and of the associates 19. The total number of members of all classes is 332.

The Honorary Treasurer next read the Annual Statement of the Society's financial condition, and both were approved and passed on a motion from the Chair, seconded by Rev. H. H. Higgins.

The following office-bearers were then elected: Vice-Presidents—Thos. J. Moore, Cor. Mem. Z.S.L., Professor J. Campbell Brown, D.Sc., &c., W. Carter, M.D.; Honorary Treasurer—R. C. Johnson, F.R.A.S.; Honorary Secretary—James Birchall; Honorary Librarian—Richmond Leigh, M.R.C.S.E.; Members of Council—Principal Rendall, M.A., John W. Hayward, M.D., J. Sibley Hicks, F.R.C.S., F.L.S., Isaac Roberts, F.G.S., F.R.A.S., Henry Longuet Higgins, Malcolm Guthrie, Josiah Marples, Rev. W. Stern, Ph.D., Robert Nicholson, Professor Herdman, D.Sc., H. H. Bremner, B.A., Chas. J. English, Robert F. Green, Rev. S. Fletcher Williams.

The Associates of the Society were re-elected.

Mr. Richard Steel, the President-elect, then took the Chair and delivered an Address on "Mind in Man and the Lower Animals.*

FIRST ORDINARY MEETING.

ROYAL INSTITUTION, October 15th, 1883.

RICHARD STEEL, PRESIDENT, in the Chair.

Miss Jessie Macgregor and Mrs. Sephton, and Messrs. R. Somervell, John Burdon, L.R.C.P., L.R.C.S., Frederick

* See page 1.

Broadbridge, A. J. Mead, and Fred. W. Edwards were duly elected Ordinary Members.

References were made by the President, Sir J. A. Picton, and Mr. Birchall, to the death of Mr. Chantrell, whose valuable labours in the promotion of scientific knowledge in Liverpool were heartily acknowledged.

The following communication was then read:—

REPORTS OF LOCAL NATURAL SCIENCE WORK DURING THE YEAR 1883.

By the Rev. H. H. HIGGINS, M.A.

A Society has been commenced for the encouragement of Astronomical Observation, especially amongst the possessors of small telescopes. Its rules were adopted on the 21st of July in the present year.

Several local stations for meteorological observations are provided with reliable instruments. The rainfall at one of these for the last nine months has been communicated by the Rev. W. Banister. The results indicate extreme dryness in April and May, ·098 and ·069 respectively, and a downpour of 5·071 inches in September.

The Liverpool Geological Association has been very active, and, though not long established, now numbers 131 members. Eleven evening meetings have been held, at several of which papers were contributed by members of the Liverpool Geological Society, shewing a hearty wish for co-operation on the part of the members of the elder Society.

Mr. Willem S. Logeman recorded before the Association some experiments in the artificial production of the diamond performed by his father, Professor W. M. Logeman, in the Tyler Museum at Haarlem.

The President, Mr. Henry Bramall, read an elaborate Paper on the "Mineral Resources of New Zealand."

Local Geology received a contribution from Mr. Isaac C. George, who has investigated the origin of the contorted appearances in the Bunter sandstones of the Wirral.

Eleven Field Meetings have been held, including an excursion of three days into Shropshire. Most of the Field Meetings have been attended by one or other of our long recognised local geologists, Mr. G. H. Morton, Mr. Mellard Reade, and Dr. Rickets. The President and Vice-President of the Association have also given active assistance.

A visit was paid to the Free Public Museum, where Mr. F. P. Marrat exhibited and described the Phillips Collection of Minerals.

To the Hon. Secretary, Mr. Osmund W. Jeffs, the writer of these notes is indebted for a very excellent summary of the Proceedings of the Association.

Circumstances led me, a few weeks ago, to revisit the bank at the mouth of a coal shaft at Ravenhead, where, in 1871, I had collected a large number of fish remains, preserved in bituminous shale forming a layer immediately above the roof of the Little Delf Coals. The specimens were as numerous as before; most of them were small, but in beautiful preservation.

The Liverpool Entomological Society has made satisfactory progress in the number of its members and in the interest of its evening meetings. The Hon. Secretary, Dr. Ellis, contributes a full account of work done by himself and friends in the department of British Coleoptera.

Taking, as a basis, two Papers communicated by Mr. C. S. Gregson to the Historic Society of Lancashire and Cheshire, in 1861–2, Dr. Ellis is completing, as far as

possible, lists of local species of British beetles, and the Liverpool Entomological Society is publishing the series in the *Naturalist*. Dr. Ellis speaks in well-deserved terms of commendation of the services rendered to local Entomology by Mr. C. S. Gregson.

Andrena fulva, one of the largest and handsomest of our spring bees, a few pairs of which I have observed every year for many years, at Rainhill, this year, for the first time, gave me an opportunity of observing its operations in tunnelling. The holes were made in the verge of a lawn, and attracted my attention as being larger than any holes I had seen made by bees known as Fossores. After many watchings a sight was obtained of the beautiful tunneller entering its nidamental burrow. It was apparently very shy of being seen to enter its nest, and further observations were interrupted.

Botany has always been the most favoured subject with the Field Naturalists of Liverpool, and there are many herbaria of great excellence owned by local botanists. Contributions of plants and vegetable productions have from time to time been made to the Liverpool Museum, and when not immediately required for the illustration of the Zoological series, such contributions have hitherto been without a suitable receptacle. The Library and Museum Committee have this year provided a cabinet which will, for the present, afford accommodation for the orderly preservation of such botanical specimens.

The excursions of the Field Naturalists' Club have brought forward several fresh names as *alumni* in Botany; and the botanical referee, Mr. Robert Brown, contributes an interesting report of Phytological work done. The following plants have been recorded for the first time within the

Liverpool district: *Lactuca virosa*, by Mr. Ed. Davies, ex-president of this Society; *Stellaria nemorum*, by Miss Longuet Higgins. The latter by no means inconspicuous plant was collected about two miles from my house, on a walk which I have very frequently taken for the last thirty years. There is no suspicion of its having been introduced. Mr. Brown records as the most interesting of his own finds, *Lepidium draba*, from the banks of the Dee, opposite West Kirby.

The Field Meetings of the Liverpool Science Students' Association have been well attended. I am glad to speak from experience of the very instructive character of these genuine botanical explorations, as conducted by Mr. A. Norman Tate.

These few brief notices must not be understood to be an exhaustive account of a year's Natural History work in Liverpool. Excellent accounts of observations appear from time to time in *Nature* or the *Journal of Science*, from Liverpool or Birkenhead writers, indicating that there are probably many good observers in science unattracted by any of our societies, and leading to the wholesome lesson that societies, and perhaps the sciences themselves, are means, not ends, and that the highest limited object is the true elevation of the human individual.

The following Communication was then read:—

NOTE ON THE PHOSPHORESCENCE OF THE SEA AT LOCH FYNE.

By Professor HERDMAN, D.Sc., F.L.S.

During a five weeks' stay on the shores of Loch Fyne in the autumn of 1883, I noticed that the sea was more or less phosphorescent nearly every night. The weather was good,

there being little wind or rain, and twice or thrice there were several successive days of almost perfect calm. At these times the phosphorescence seemed to be more brilliant. When tow-netting after dark on such occasions, the net soon became outlined by a bright glistening band, which was visible in the water at a considerable distance. The surface fauna as determined by the tow-net gatherings was large in amount, but most of it was formed of small crustaceans.

I first satisfied myself that the phosphorescence was not due to the *Copepoda*, which were very abundant. From a basin containing phosphorescent water from the tow-net, I drew off small tube-fulls frequently which phosphoresced in the dark, and upon examination were found to contain no Copepods. I also frequently isolated Copepods in tubes and watch glasses, and noticed that these did not phosphoresce in the dark. I then examined samples of the water and tow-net gatherings carefully in the hope of finding *Noctiluca*, but did not see a single specimen during the five weeks. Lastly, I tried to isolate the phosphorescent particles while bright. I soon found that the best plan was to get them from the muslin of the tow-net, which remained a glowing surface when agitated in the dark, for an hour or so after having been used. When a glass slide to which some of the glowing particles had been transferred was examined microscopically, it was found invariably to have several specimens of the cilioflagellate *Peridinium tripos*, usually along with other organisms. I then began to suspect that *Peridinium* was the cause of the light, and made various attempts to induce specimens to phosphoresce under the microscope, but without success. I managed, however, a number of times to transfer glowing particles from the tow-net to small cover glasses ($\frac{1}{4}$ inch square) and upon examining these under the microscope invariably found

one or several specimens of *Peridinium* in the field, in most cases alone, but occasionally along with one or two organisms.

Although this did not prove conclusively that *Peridinium* was the phosphorescent organism, since I never actually saw the phosphorescence under the microscope; still from the large number of times when I observed *Peridinium* in the place of the glowing particle, I am morally certain that to this organism the luminosity of the sea was due upon this particular occasion.

Selections of rare plants living in the Liverpool Botanic Garden were sent by Mr. Richardson, the Curator, for exhibition, and were severally remarked upon by the Rev. H. H. Higgins.

RECENT ADDITIONS TO THE LIVERPOOL FREE PUBLIC MUSEUM.

By T. J. MOORE, Curator.

Mr. Moore exhibited and made remarks on the following specimens:—

Pontoporia.

A specimen of one of the smallest known Cetaceans, *Pontoporia Blainvillii*, from the estuary of the River Plate; one of two examples expressly procured for the Museum, by Mr. Juan D. Jackson, of Monte Video, at the request of Mr. P. H. Rathbone. They had been preserved in salt, from which they had only been removed this day. One measures four feet four inches in length, and the other three feet eleven inches.

As recently as 1866, nothing was known of this creature except a skull in the Paris Museum and one in the British

Museum. The above acquisition is therefore of considerable importance.

Among the toothed Cetaceans are found all the smallest species of the whale tribe, each measuring only a very few feet in length.

These species are three in number. One, named *Inia,* is found only in the upper waters of the Amazon river, and therefore strictly inhabiting fresh water only.

The second, named the *Susu* (*Platanista*), is remarkable for its peculiarly long and slender beak, with its sharp teeth increasing in length to the tip of the snout. It is found only in the fresh waters of India, in the Ganges and Indus. Of this kind the Museum possesses two native-stuffed specimens, as well as skulls and bones.

The third is the *Pontoporia,* which, like the first, is South American, but, unlike the kinds previously mentioned, is not certainly a river species, having been captured only at the mouth of the Plate and some distance out at sea.

The Museum is fortunate in now possessing examples of two out of the three known kinds of these diminutive cetaceans. For it is to a study of these that Professor Flower has quite recently referred in his article on Mammalia, in the new edition of the *Encyclopædia Britannica,* as throwing some light on the probable nature of the ancestors of the whole whale tribe.

"The fact that the Indian species, the *Susu* or Ganges Dolphin (*Platanista*), appears to retain more of the *primitive* characters of the group than any other existing form; and that this, and also the somewhat related *Inia* from South America, are both to the present day exclusively fluviatile, may point to the fresh water origin of the whole group, in which case their otherwise rather inexplicable absence from the seas of the Cretaceous period would be accounted for."—(Flower, *Encyc. Brit.*, Mamm., p. 394.)

COLLECTION FROM MR. A. W. CRAWFORD.

Poisonous Lizard, Heloderma.

Selections from a collection of Natural History specimens, chiefly from California, containing numerous specimens of Reptiles, Amphibia, Insects, Crustacea, Echinoderms, and a large series of Mollusca; also some botanical and rock specimens; presented and mostly collected by Mr. A. W. Crawford, Oakland, California, formerly of Liverpool.

The most important object in the collection is a fine example of the Poisonous Lizard, *Heloderma*, preserved in spirit.

The specimen measures thirteen inches in length, is stoutly built, with rounded head and body, short limbs, with five toes to each; head, body, and limbs covered with shield-like scales; and is blotched with yellow on a blackish ground colour throughout.

The genus was first described by Wiegmann, a German naturalist, in the *Ibis*, in the year 1829, under the name of *Heloderma horridum;* but specimens are still rare in museums. Two examples from Mexico are recorded by the late Dr. Gray in his *Catalogue of Lizards* in the British Museum, 1845. He called them the Caltetepons (probably the Mexican name), and regarded them as a separate family from all other Lizards, and placed them immediately after the family of Monitor Lizards, which heads the list.

Lizards have generally been believed by naturalists to be non-poisonous reptiles, notwithstanding native ideas to the contrary; and the true character of the *Heloderma* does not seem to have been very generally credited. Mr. Crawford, who collected this specimen in Arizona, was not aware of it, though he has been much in that part of America. Mr. Councillor Charles McArdle, of Liverpool, who has travelled in Arizona, has assured me personally that, though he had

often seen specimens when out shooting, he did not know of their poisonous qualities.

In July, 1882, Sir John Lubbock presented to the Zoological Society of London a living specimen of *Heloderma*, lately received by him from Arizona, without any warning by the sender of its being a dangerous creature. I have been informed by Mr. Misselbrook, the Head Keeper of the Society's Menagerie in the Regent's Park, that it was slow and sluggish on arrival there, and was handled with impunity by the keeper in charge of the reptiles. Experiments, however, were shortly after tried as to its poisonous character. Mr. G. A. Boulenger, Aide-Naturalist of the Royal Belgian Museum, thus reports in the *Proceedings* of the Society, 1882, p. 631:—

"A few days after the arrival of the *Heloderma* in the Society's Menagerie, I tried the effects of its poison on a Guinea-pig. The animal was bitten in the leg, and, after two or three minutes, fell into convulsions and died, exactly as if bitten by a viper. Besides, no doubt could be entertained as to the poisonous nature of the *Heloderma* after the careful investigations recently made by Dr. J. G. Fischer on the poison-glands of a specimen preserved in spirits. On one occasion, Dr. Fischer tells us, the gentleman who procured the specimen and kept it for some time alive in Mexico, was bitten when handling it, and that the effects were of a very serious nature. I may add, that the *Heloderma* is probably not the only poisonous Lizard. *Lanthonotus borneensis*, a pretty close ally of this lizard, described four years ago by Dr. Steindachner, exhibits, according to that author, a similar dentition."

Sir Joseph Fayrer also says (*l. c.*, p. 632):—"On the 31st August, I was present when the *Heloderm* bit two Guinea-pigs in the hind leg, at about 9.30 a.m. The bites were viciously inflicted; and the lizard did not readily

relinquish its hold. . . Mr. Bartlett" (the Superintendent) "wrote to me that both Guinea-pigs died, the larger one about two and a half hours after I saw it; the other at night."

Mr. Horace Smith, of Philadelphia, informed me, on seeing the specimen from Mr. Crawford at our Museum, that one was lately living at Woodward's Gardens, San Francisco.

[In a copy of the *Smithsonian Report*, 1882, which came to hand while these pages were passing through the press, I find at p. 625, the following note:—"A large lizard, of an orange and black colour, with a skin tuberculated or covered with scales, simulating the heads of nails, and hence called *Heloderma*, is a common inhabitant of Arizona. It is dreaded by the inhabitants of the territory and deemed by them to be poisonous. The allegations to that effect, however, have been doubted by naturalists, because none of the lizards had been acknowledged to be venomous. *Heloderma* differs from other lizards, however, in having grooved teeth and efferent ducts of the salivary glands discharging at the bases of the grooves. The best informed herpetologists have therefore acknowledged the possibility, if not probability, of the truth of the popular belief, and Professor Cope, years ago, named the Arizonian *Heloderma, H. suspectum,* with reference to the bad reputation of the animal. Recent experiments and the personal experience of Dr. R. W. Shufeldt have demonstrated the correctness of the belief as to the poisonous character of the lizard, and we have now the certainty that the representatives of one type of lizard—the family of Helodermids, with one genus and two species—are venomous. Dr. Shufeldt has recorded the effects of a bite, which was immediately attended with violent inflammation, in the *American Naturalist* for November, 1882, (v. xvi, pp. 907–908)."—T. J. M.]

Golden Winged Bird of Paradise.

Two fine stuffed male specimens of the Golden-winged Bird of Paradise, *Diphyllodes chrysoptera*, Gould, from New Guinea, which had been kindly presented to the Museum by Dr. George Bennett, F.L.S., F.Z.S., Corresponding Member, who had forwarded them in skin from Sydney, by Mr. J. G. Roberts, a member of the Society, who had recently been on a visit to Australia.

Dredgings, &c., by Dr. S. Archer.

Selections from a large collection of specimens from Singapore, chiefly Marine Invertebrates, specially dredged and collected for the Museum, by Staff Surgeon-Major S. Archer, Corresponding Member of the Society, and presented by himself and his brother, Mr. Frank Archer.

The collection is rich in Crinoids and other Echinoderms; in Flexible Corals, of which several beautiful specimens were exhibited; and in Crustacea, the examination of which last is about to be undertaken by Mr. Alfred O. Walker, of Chester.

Dredgings, &c., by Captain Cawne Warren.

Selections from a collection of Marine Specimens, dredged and collected between Liverpool and Callao, and presented by Capt. W. H. Cawne Warren, ship "Bedfordshire," Associate of the Society.

This collection comprises many dredgings, preserved in spirit, of Molluscs, Starfishes, Echini, Corals, &c., in 40 to 80 fathoms, from the Patagonian Bank, and gatherings from Callao Bay, Concepcion and Talcahuano Bays.

Dredgings, &c., by Captain S. Griffith Jones.

Selections from a collection of specimens, chiefly small

Marine Invertebrates, dredged between Liverpool and the West Coast of South America, together with date and place of capture, and other notes and observations, collected and presented by Capt. S. Griffith Jones, barque "Hermine."

The specimens have been collected, preserved and noted with extreme care. Numerous observations are recorded, especially on the various kinds, degrees and position of the luminosity in the minuter forms of Crustacea, &c.; also of various specimens of Pyrosoma, of which several examples are well preserved. Of specimens of *Serolis*, a flat trilobite-like Crustacean, of rounded outline and with deeply serrated margin, he dredged several from a sandy bottom in 55 fathoms, in lat. 42° 43′ S., long. 59° 28′ W., and on placing them in a vessel with some of the sand brought up, he observed that "they make use of their colour, which is the same as the sand, to hide themselves as though from their enemies. As soon as they are startled they raise a cloud of sand which falls on them, when they are hard to be detected from the sand itself;" a habit common to many crustacea, fish, &c., to deceive their enemies or to delude their prey.

Of specimens of the Marbled Angler Fish and Pipe Fish from the Sargasso Seas, and of the Carinaria and Janthina, kept alive on shipboard, Capt. Jones's observations are appended below.

NOTES ON SPECIMENS OF THE MARBLED ANGLER FISH, PIPE FISH, JANTHINA AND CARINARIA, KEPT ALIVE AT SEA.

By S. GRIFFITH JONES, Commander of the Barque "Hermine."

Marbled Angler (*Antennarius-Cheironectes*, part, Cuvier). *Sargasso Sea.*

14th April, 1883.—Caught a small Marbled Angler three-quarters of an inch long, which I intend to keep alive

to watch its daily actions. I shall call it "Johnny," to distinguish it from other Anglers I may obtain in a few days.

18*th April.*--Up to this date little "Johnny" kept very quiet while I was looking at him, but I kept missing small Crustaceans and Entomostraca which I had put in the globe.* To-day, no sooner had I thrown a small Crangonoid into the globe than he darted at it, took it by the middle, and in a few seconds swallowed it doubled, notwithstanding that it was one-quarter the size of himself.

19*th April.*—I find that "Johnny" has bit the tail (caudal fin) off a small Pilot-fish, now in bottle 118. Having obtained a sprig or nodule of Gulf-weed, I put it in the globe. No sooner than "Johnny" saw it but he felt all at home at once. He flew among the branches, and took a firm grasp of the weed with his pectoral fin, which is supported by ten spines which answer the purpose of fingers. The ventral hung down ready to take hold of anything that passed.

I now noticed that the water he breathed from passed through two small gill holes behind his pectoral fins. These holes have a flap, and are nearly semi-transparent.

Whenever "Johnny" had his stomach filled he lay quiet, with scarcely any sign of life in him, his fins twisted in every shape. This was evidently a deception in order for his

* A "Mortimer Ship-Aquarium," the invention of Captain J. H. Mortimer, Premier Associate of the Society, a supply of which, with Dredges, &c., had been supplied to Captain Griffith Jones, from the Museum. The utility of this simple contrivance, an ordinary fish globe resting on a disk of wood, slung by three cords to a ring for hanging on a hook from the cabin ceiling like a cabin lamp, is evidenced by the observations here recorded and by the fact of numerous living fish having been brought to the Museum by friendly Captains and others, *e.g.*, young Sturgeons from Hamburg, amphibians and various small fish from the United States, Brazil, Peru, West Africa, Point de Galle, and the Mediterranean, several of which have been brought before the notice of the Society.—T. J. Moore.

meals to come near his mouth. I did not see him making use of his so-called angling rod to catch anything, but rather, he darted after his prey with the speed of an arrow. Sometimes "Johnny" gorged himself with small shrimps till his stomach was distended fit to burst, and the crustaceans' long feelers were sticking out of his mouth. Having obtained a nest of the Marbled Angler, I put "Johnny" with it into the globe. He instantly went among its loose fronds, but did not penetrate the nest. Finding the nest too strong for the little water in the globe to remain pure, I put "Johnny" back in his own globe, and put several other Anglers along with him, one of which was about three times the size of "Johnny." Both Anglers seemed to avoid one another, and kept themselves among the weed.

Having obtained another nest, full of eggs, I put one of the larger Anglers in the same globe with it. No sooner was the fish loose than it darted into the middle of the nest, and I saw it no more. Evidently, it knew it at the first glance. Both nests were put in jars, and preserved in spirits. The above fish is in the middle of the one in No. 122.

25th April.—Since the above, we have seen dozens of the above nests. They are not easily recognised, except by those who have seen them before. A few fronds are above water. They generally float by themselves, and it is seldom we find a nest in the middle of a large field of gulf-weed.

When the nest is fully formed and the eggs deposited, the parent Anglers are never in the inside; but I saw them several times in great excitement plying about their nest when the ship touched it as she passed through. They seldom went more than a few yards off, but kept returning and examining their nests. There were always two together. I have often seen *small* Anglers on the inside, but I think

that they remain there for protection until they are big enough to take care of themselves on the outside.

15th May.—Since writing the above, "Johnny" has been lost. Perhaps the bigger Angler,* which still lives, ate it. This one was caught among gulf-weed.

Pipe Fish (*Syngnathus*).

Sargasso Sea.

May, 1883. Caught several of the above fishes. They seem to be of a different species from those that are near the British shores. These were obtained in bunches of gulf weed. They do not seem to be timid, because they will allow me to scratch them or handle them as I wish. They are very lazy in their movements, much more so than one might expect from their shape. They have been eating small crustaceans while in the globe; their beak will stretch twice or three times its present size when they want to swallow. They will not eat anything dead, it must be alive and moving. They have been very quiet since we came to cold weather. We have had two batches of young ones, but they did not remain more than two or three days; either the pipe fishes or "Johnny" (a Marbled Angler Fish in the same vessel) ate them up; perhaps both. One gave birth, or rather discharged, about two dozen young pipe fishes. They were about three-quarters of an inch long, very lively, and exactly of the same shape as their parent. One is still with young;

[* This specimen was forwarded from Cork (where Capt. Jones had called for orders) by steamer to Liverpool, for the Museum. It arrived alive, but weakly, and only survived a day or two. This was the second specimen which had been received here alive; the first was brought by Capt. J. H. Mortimer, in one of his ship-aquariums, several years since, with a living example of *Nassa*, or Dog Whelk, which is carnivorous. This Marbled Angler lived for a longer period, but was ultimately found dead under circumstances so suspicious that a verdict of wilful murder against the Dog Whelk was found by the jury empanelled for the inquest.—T. J. Moore.]

I expect them out by the end of May. Both "Johnny" and the four pipe fishes have become accustomed to each other for some time past. When I take the globe on deck in fine weather, all are very lively, darting in and out of the weed and passing each other like ladies' chain in *cotillon.*

Between the Azores and England we passed a great number of dead pipe fishes, both this year and in June, 1880. They floated on the surface, generally with their head downwards.

VIOLET SHELL (*Janthina*).

Sargasso Sea.

26*th* to 29*th April,* 1883. In this part of the ocean these creatures seem very abundant, several in sight at one time. Caught about three dozen or more. Evidently it is their breeding season, almost every one has egg-sacs attached to its float. Also many floats, with the egg-sac attached, are floating about without the animal, the latter no doubt having left to the float the safety of the eggs. The sacs, when the eggs are first deposited, are of a pale colour. They soon become of a pretty pink, and when ripe—the young *Janthinæ* having attained a size just big enough to be seen by the naked eye—they are of a coffee brown or chocolate colour. Some have a different float from the others. The cells are larger and more systematically arranged. All the floats, with egg-sacs attached, were cells of different sizes, arranged without much order, some larger and some smaller. The *Janthinæ* are very voracious, and are exceedingly fond of the softer parts of the *Velella.* On holding a *Velella* near their mouth they darted it out at once, and took a mouthful, and swallowed it more slowly. Their long rows of teeth are quite visible when they open their mouths. I have seen one *Janthina* eating a third of a moderate-sized *Velella.* They also eat up one another; the strongest will even break the

shell of the weakest to get at its soft parts. More than two-thirds of those that I kept alive in the globe were destroyed by the other third, and the shells more or less broken up. I have reason to believe that it is seldom they can reach the whole animal, as it retires too far inside the whorl. I have also reason to believe that this animal will build itself up again, the shell growing into shape, notwithstanding its former mutilated condition. I have one shell here which shows how well it has grown after its first mutilation. See the largest shell in bottle.

Whenever I separated one that was devouring the other, the coloured liquid flowed freely from the subject of the attack; but its shade was more of a purplish violet than the colour of the stuff they discharge when disturbed by hand.

Carinaria.

21st May, 1883.—*Lat.* 50° *N.*, *long.* 14° *W.* Caught a very lively Carinaria; put it in a bottle of water with some sea-weed which was covered with small barnacles. This animal swims with the shell downwards. The motion of the dorsal fin is very similar to that of the Pteropoda. This animal was not long in the jar before it became aware of the barnacles. It then made a rush for them; opening its mouth very wide, it took a bunch off, and seemed to masticate it for some time, but I failed to discover any passing into the digestive sac. It made itself at home at once, and, on the 22nd, seemed as lively as ever. Its digestive sac seems to get emptied gradually, for it is not half as big as on the 21st.

22nd May. *Lat.* 51° *N.*, *long.* 13° *W.* Weather very fine and calm. Caught another Carinaria. Put them together in the same jar, but they did not associate at once with one another. Both kept swimming round rapidly, occasionally taking a mouthful of small barnacles when hungry. While

I was watching, the new comer stealthily crept under the other one, putting its syphon-like mouth into the shell of the other, and took, or appeared to take, a mouthful of the gill feathers of the other; the latter struggled violently as soon as it found it out, and seemed very careful not to let the new one approach near again. Out of four woodcuts which I possess of the Carinaria, none of them is good. I give herewith the outline of one of these animals in my jars, with notes on the same. I give it in case they will not live, for when dead their head is drawn in. The animal is semi-transparent, or translucent, with the exception of spots indicated in the drawing,* which are of a dark colour.

23rd May. To-day the two Carinarias seem to be friends. They play with one another, and feed from the same bunch of barnacles. There is a small piece of barnacle on its way to the stomach, but I find that they only suck the juice of the animal, ejecting the refuse after forty to sixty seconds.

24th May. Off Mizen Head Island.—This morning I found the Carinarias dead, one having ejected its stomach through its mouth. They were very lively at eleven o'clock last night. I suspect that they have been fighting.

They are now in bottles 142, 143. Their shape, as I suspected, is very different from that when they were alive.

Mr. Isaac Roberts, F.G.S., F.R.A.S., made some observations on the planet Jupiter, as seen that morning without his satellites.

The Rev. H. H. Higgins, M.A., followed with a short paper entitled, "A Plea for Bidston Hill," which led to the unanimous adoption of the following resolution, proposed by Dr. Carter, and seconded by Mr. J. Sibley Hicks, F.R.C.S., "That in the opinion of this meeting, it is highly desirable

* It is matter of regret that the very carefully noted drawing, sent by Capt. Jones, is unavoidably omitted here.—T. J. M.

that Bidston Hill should be preserved in perpetuity as a place of public resort, and that a copy of this resolution be sent to the Mayors of Liverpool and Birkenhead."

The paper was as follows :—

A PLEA FOR BIDSTON HILL.

By the Rev. H. H. HIGGINS, M.A.

Most heartily do I join in deprecating the consignment of Bidston Hill to the hands of Villa Builders. The locality, as connected with the history of Liverpool, has in many respects an interest which is quite unique. Almost within my own memory telescopes were pointed from Tower Buildings to a long row of signal posts near the Lighthouse, indicating by a code of signals any vessel that might be sighted in the offing. There is something quaint now in the simplicity of such an arrangement, but merchants of the last generation, whose names and memories Liverpool delights to honour, regarded those rude semaphores with intense solicitude. Perhaps in a few years there may not be many to care on such grounds for the spot, but so long as it is a wild place some old men will go there and talk to children of signals, and ships, and famous firms that were the light of Liverpool in other days.

It is to be feared that my next plea for Bidston will be thought still more fanciful; but, indeed, it is a claim founded upon the advanced Natural History of the present day. If the hill were crowned by the remains of some old feudal fortress bearing architectural evidence of an early Norman origin, the ruins would at all events secure immunity from destruction for themselves and for a considerable area of their surroundings. Now it happens that on the hill, and on the marshy ground stretching out nearly to the Upton road, are found a considerable number of plants, separated by very wide intervals from other plants of like kinds. It is probable

that at some more or less remote period these plants were distributed at much less intervals; but cultivation, the disappearance of forests, and the consequent diminution of rainfall have reduced their representatives to a few small outlying plant settlements, just able to maintain their existence from season to season. The discovery of a flower which has thus become nearly extinct in a district elicits a feeling closely allied to pity, and even a feeling to which pity is said to be akin, as if the plant were leading a forsaken unprotected life. Root cutters, and herb collectors for sale, must be reckoned among the actively-destructive agents; but marketable wild plants have mostly disappeared long ago; and to every true botanist the wilful eradication of a rare plant is a misdeed to be classed with the profanation of a sacred shrine. The Marsh St. John's-wort, whose velvety foliage I have seen covering with summer green and gold the surface of spongy pools in county Kerry, may be found in a marshy nook near Bidston, but not again nearer than Halsall. Several other charming wild flowers of the locality, as the Marsh Gentian and the Shepherd's Cress, have thus become isolated. But the true descendants of the vegetable aborigines of Bidston may be found amongst other cellular Cryptogams, the Mosses and the Lichens, and the Scale-worts. For some of the more interesting forms amongst the Lichens and Scale-worts, *e.g.* the ciliated Scale-wort, I know of no other locality within fifteen or even twenty miles. Nor is it, I think, improbable that amongst the encrusting Lichens there may be plants of marvellous antiquity—older than a venerable oak-tree—older than Liverpool itself. Mr. Ruskin may have truth, as well as poetic beauty of expression on his side when he says, "Far above, among the mountains, the Silver Lichen spots rest, starlike, on the stone; and the gathering orange stain upon the edge of yonder western peak reflects the sunsets of a thousand years." The well-known

Iceland Moss, which is a Lichen, was found by myself growing on Bidston Hill. It would be idle to guess at the number of centuries which have elapsed since this true child of the sub-alpine moorland was connected by continuity of suitable soils and favouring environments with the moels of Wales and the barrows of North Lancashire—for such are its native haunts; and there is no way of accounting for its presence here except through the growth of intermediate living examples.

Of such considerations, it may be said that they can affect comparatively only a small number of the community. And this is true. But many correspondents of the local Press—and I must particularise the *Daily Post*—have already, with much ability and earnest feeling, advocated the interest of the public generally in preserving Bidston Hill. But they have not, so far as I know, referred to an aspect of the case on which I now enter with some reluctance—I mean the sadly restricted opportunities enjoyed by our fellow citizens, and their Cheshire neighbours, for pleasant walks within moderate distances.

One of my early papers before this society was on "Some of the principal stations for Botanising in the neighbourhood of Liverpool." This was read in 1858, when all these stations were free and open as the day. Many of them have been built upon, and are now pleasant homes, producing nothing botanical except a large crop of olive branches. On the Formby shore the run was clear amongst the sandy dunes from Bootle to Southport. Now you would be "warned off" every mile or so by keepers. The warren at New Brighton was the sweetest truly wild spot so near Liverpool. Permission to wander there was always granted by the proprietor, and in the autumn the place to a lover of Nature was enchanting. Now, a street is driven right through the midst of it.

It would be tedious to name the many pleasant Liverpool walks now closed to the public, but that which is probably the greatest loss is the changed character of a whole class of localities, of which Eastham and New Brighton are the chief. No one ought to grudge the pleasure and the benefit afforded to hundreds of thousands of excursionists by the popularisation of the Mersey shores; but cheap-trippers have their own ways, some of which are objectionable, and a quiet well-to-do member of the lower middle class cannot as formerly take his family for an afternoon to any of the places of popular resort by the river. I have no charge to bring against the trippers; I see tens of thousands of them in the Museum, and they are often very intelligent; but I observe that on their days they have the free public galleries pretty much to themselves. The parks, no doubt, are of inestimable value, and some of them, notably Claughton Park, may be cited as attaining a very high standard of beauty; but there the worthy citizen, disporting himself with his family, feels a load of responsibility lest there should be in his little party law-breakers heedless of such directions as "Keep on the walks." And if, tired out, he fling himself at full length on the turf in the warm spring sunshine, it seems but a moment before he has to raise his head. "Where's that fellow Tom? he's off bird-nesting, I know; and Nelly? she's not far behind him, if she be not plucking the flowers."

Heads of wealthy houses, who feel that ye can hardly breathe freely by the Grimsel or the Matterhorn, but must plunge into Dovrefeldts or run the prows of your yachts into some Northern fiord, do you think that nothing of this feeling is known to the clerks in your offices? Very likely it is unknown to many that the air on Bidston Hill is as pure and free as on Monte Rosa, and that the ling grows there for any child to pluck, and wild as does the boasted

edelweiss upon the rocks in Helvetia. Shall the spot, like some parts of New Brighton and other places, be forced into the vulgarities of roads enclosed by nine feet walls, hateful to many tenants of the houses, and, to the wayfaring man, the very "horns of the oppressor"?

Once Bidston is gone it is gone for ever; and it is the last truly sub-alpine spot where the wearied quill-driver may come on God's blessed day, and feel whose heaven is above him, and whose earth is beneath him, and all without fear of clipping the Sunday rest, or adding an hour to the toil of any child of industry. Were I wealthy, I would sooner secure Bidston permanently for the free enjoyment of Liverpool and Birkenhead than I would build for them a Kremlin or a Vatican.

SECOND ORDINARY MEETING.

Royal Institution, October 29th, 1883.

RICHARD STEEL, President, in the Chair.

Mrs. Guthrie and Messrs. Wm. Knowles Stretch, and Chas. H. Green were elected Ordinary Members.

Dr. Nevins read a short communication, illustrated by Tables and Diagrams,

ON THE PHYSICAL DIFFICULTIES IN THE CONSTRUCTION OF THE PROPOSED MARITIME CANAL THROUGH THE JORDAN VALLEY.

During the meeting of the British Association in Southport, a paper was read on the proposed Jordan Valley Canal, and the reader, a C. E., who had been examining the country, appeared to think the proposal a practicable one, and seemed

also to be in favour of it. During the discussion on the paper, in which Canon Tristram and others took part, the Canon said that even if the two proposed connecting canals from the Mediterranean and the Red Sea could be made, and other objections overcome, it would still require nearly a hundred years to fill the Jordan Valley so as to make it a navigable course.

In the conversations on the subject on 'Change and elsewhere, ridicule was often thrown upon the length of time suggested, which was said to be extravagant. Dr. Nevins, therefore, brought before the Society an estimate of the length of time that would probably be necessary, based upon such data as are at present available.

These are at present very imperfect. No accurate survey has been made of the mountain ranges separating the Mediterranean and the Red Sea from Palestine, so as to give definite information as to the nature of the rocks through which the cuttings would have to be made, and the consequent ease or difficulty of that part of the undertaking; of the faults liable to be met with that might swallow up more or less of the water passing through the canals; or of the character of the canal beds when made, and their influence arising from friction and wear and tear upon the streams of water passing through them from the two seas.

But leaving all these elements of doubt out of the question, and *assuming a total absence of loss from any source whatever*, friction, evaporation, or faults in the canals themselves when made, or in the Jordan Valley itself, *the length of time arrived at as requisite for filling the Valley through the two proposed canals would be, approximately, fifty-four years*, based upon the following calculations:—

DATA.—*The data upon which to work are the following.*

The Jordan Valley contains, approximately, 2,800 square miles, which is about the area of Lancashire, omitting the

detached north-western corner of Ulverston and Barrow-in-Furness.

Its depth below the level of the Mediterranean varies from about 600 feet to 1,600 feet. An average depth of 1,000 feet was therefore assumed as a working approximation. Loughrigg Fell, so well known at the head of Windermere, is about this height.

The two canals are each to be 100 feet wide by 30 feet deep, so as to allow of ocean-going steamers meeting or passing on the way.

The ordinary laws of hydrostatics and of hydraulics (omitting loss from friction) are available for arriving at the *minimum time* that would be requisite.

Engineering works on canals, rivers, &c., are available for estimating the *actual flow* of water through artificial canals, with the loss from friction, &c., that would retard the flow below the theoretical amount, and would so far prolong the time necessary for filling the valley.

The Mediterranean Canal would be about twenty-six miles long, and that from the Red Sea about 140 miles long. But this (from circumstances to be mentioned hereafter) would affect the length of time necessary for making the canals, rather than the amount of water flowing through them for the purpose of filling the valley.

PROBLEM TO BE SOLVED.—The problem to be solved is, therefore, "What is the *minimum time* that would be requisite for filling a valley the size of Lancashire to the depth of the summit of Loughrigg Fell (1,000 feet), by means of two canals, each 100 feet wide by 30 feet deep, fed from an unlimited supply of water?" *No allowance is to be made for loss from any source whatever.* Any loss from friction, evaporation, &c., would prolong the *minimum* time.

The SPACE TO BE FILLED is 2,800 square miles × 1,000 feet deep = 2,800 square miles × 3,097,600 square yards

per mile × 333·3 yards deep = 2,890,810,890,000 cubic yards to be filled. WHAT IS THE AMOUNT OF WATER FLOWING PER MINUTE THROUGH A PERFECTLY UNOBSTRUCTED OUTLET, 66·6 YARDS WIDE AND TEN YARDS DEEP, WITH AN UNLIMITED AND UNIFORM SUPPLY OF WATER? (The two canals each 100 feet wide by 30 feet deep.)

The answer to this question is not easily given, partly owing to the scarcity of experiments which bear exactly upon the data, and partly owing to the conflicting estimates and formula given in works on hydraulics, in which *the retardation from friction is, of necessity, taken into account.* The amount of water discharged through a given space is also not uniform, but depends upon the depth of the vent (pipe or trough, &c.) below the surface; the theoretical amount (independent of friction) being as the square root of the depth of the aperture below the surface. Taking, however, what have appeared to the author of this communication to be the most trustworthy approach to accurate data, *the* MEAN *amount of water discharged through an aperture one yard square in a depth of ten yards* = 2·55 cubic yards per second, which multiplied by 10 yards deep equals 25·5 cubic yards in the whole depth. This multiplied by 66·6 yards, the width of the two canals, equals 1,698 cubic yards per second, which multiplied by 60 equals 101,898 cubic yards per minute discharged through the given aperture. This multiplied by 60 minutes × 24 hours × 365 days equals 53,557,588,800 cubic yards per year discharged through such an aperture, *assuming no loss from friction.* Then 2,890,810,890,000 cubic yards to be filled ÷ 53,557,588,800 cubic yards of water per year = 54 years, the MINIMUM *time requisite for filling the Jordan Valley, through the proposed two ship canals.*

As, however, the water must pass through one canal about twenty-six miles long, and another about 140 miles long, there will be some loss from friction, but as the calcu-

lated flow would be barely two miles an hour in a level canal, the friction would not be great. It was therefore *assumed*, in calculating the above fifty-four years as a minimum, that the canals would be horizontal, and that the discharge of water from their open extremities into the Jordan Valley would be substantially equal to the escape through a simple flood-gate, 66·6 yards wide and 10 yards deep.

Discussion on Inclined versus Level Canals.

In the discussion which followed, it was said that the above estimate of time had been based upon a condition that no practical engineer would think of adopting, for no such engineer would make a horizontal canal, and an inclination of even only five feet in a mile would very largely increase the amount of water discharged in a given time—would, in fact, treble it.

Dr. Nevins replied that he had calculated throughout upon the *maximum* amount that would be discharged through a simple sluice or flood-gate, without the intervention of any canal whatever; and that although the friction and obstruction from a horizontal canal might retard the flow of water, no amount of inclination in this canal could increase the initial amount discharged from a simple aperture without any obstructions.

Upon the general principles of falling or rolling bodies, the *velocity* of the stream would be increased by a slope in the canal bed; but as the *amount* of water entering the canal from the Mediterranean, or other reservoir, would not be increased by this increase of velocity in the canal (which would become greater with every additional yard in its length), *the depth of water in the canal would diminish as its velocity increased*, so that *the actual amount discharged would be the same whether it was delivered rapidly as a shallow stream, or slowly as a deep one.*

In order to illustrate this practically, he brought to the society a reservoir containing water, near the bottom of which an aperture had been made, which was closed with a valve. In this aperture a tin trough was fitted, which moved upon a hinge, and admitted of being placed horizontally or at any angle of inclination.

The experiment was then tried before the meeting of testing the length of time necessary for discharging a certain amount of water through this trough when horizontal, and when it was inclined at an angle of 45°, and the result was that the time was practically equal in the two experiments. The actual difference of time was two seconds, but the experiments were roughly tried, and the result was conclusive that upon a small scale, at any rate, this inclination of the canal made no difference.

A number of works by hydraulic authorities were appealed to in the discussion, and the tables contained in their works showed conclusively that *the velocity of the flow increased with the inclination of the canal bed,* and also that the amount discharged was greater in proportion to the inclination *provided* the *depth of water in the canal was the same—i.e.,* an inclination of ten feet per mile, with a depth of thirty feet of water in the canal mouth, would give a larger discharge than an inclination of only one foot or of five feet per mile, with an equal depth of thirty feet of water. But none of the tables quoted showed that the depth of water *would* remain the same if the inclination and consequent velocity were increased. They gave the results from a given inclination and a given depth of water, but they did not meet the question (which has to be answered by the ordinary laws of falling bodies and hydrostatics) as to how much the depth would be diminished by an increase of velocity in the stream, the original supply of water into the canal remaining unaltered.

It appears, then, that with the maximum discharge of water possible, and without loss from any source whatever, it would require about fifty-four years to fill the Jordan valley through the two proposed canals.

Inevitable Sources of Loss.

It is certain, however, that there would be loss from at least three causes—Friction, faults, and evaporation.

Loss from Friction.—The amount of this loss is at present purely conjectural, as it depends so materially upon the nature of the ground through which the canal must be cut. If it is chiefly hard rock, the friction will be comparatively small, but the original difficulty of making the canal will be greatly increased. If, on the contrary, the bed of the canal is gravelly, sand, or soft rock, the difficulty of making the canal will be lessened, but the friction will be proportionately increased. It is believed at present that a great part of the mountain ranges to be cut through is hard rock.

Loss from Faults.—This also is at present purely conjectural, and can only be learnt as the cutting proceeds through the intervening mountain ranges, and as the water eventually accumulates in the Jordan valley.

Loss from Evaporation.—This will certainly be very great. Evaporation is in proportion to the surface exposed (*ceteris paribus*), and at the present time, and for all historical periods, the evaporation from the Dead Sea is just balanced by the water flowing into it from the Jordan. If, then, the evaporation from this sea, which is about three hundred square miles in area, is so great, the loss would be very large from an area of two thousand eight hundred miles, or nine times its size. The *minimum* possible period of fifty-four years above calculated is certain, therefore, to be very much extended in reality, and the round estimate of a

hundred years as the necessary period may not be very far from the truth.

INFLUENCE ARISING FROM THE LENGTH OF THE CANALS.

It is an important question (in theory, at any rate), what influence the length of the canals themselves would produce upon the output of water into the valley, and the answer would scarcely be anticipated beforehand—it is, "None." If the canals are inclined a few feet per mile (which was assumed in the discussion as certain to be the case), the velocity of the stream would increase with every increase of length; and if friction did not interfere, the velocity would be almost beyond conception at the bottom of an incline a hundred and forty miles long. But works on hydraulics, and the tables and formulæ for canals and rivers of almost horizontal beds, which are given in Beardmore's *Manual of Hydrology* (a standard work among water engineers), show that the increased friction practically balances the increase of velocity when the bed of the canal is a fairly good one and the incline is moderate, and that the output of water from a canal of one mile, or five miles, or of twenty or a hundred miles in length is substantially the same. The length of the canals may therefore be left out of consideration in estimating the probable length of time necessary for filling the Jordan valley.

This communication elicited considerable discussion, in which Sir J. A. Picton and Messrs. Beloe, Abbott, Ball, and Johnson took part. A Paper on the general subject of the Flow of Water in Canals was read at a subsequent meeting, by Mr. Beloe.*

Sir J. A. PICTON, F.S.A., then read a Paper entitled "A Pilgrimage to Olney and Weston Underwood." †

* See page lxxviii. † See page 35.

THIRD ORDINARY MEETING.

ROYAL INSTITUTION, November 12th, 1883.

RICHARD STEEL, PRESIDENT, in the Chair.

Mr. W. Henry Finlay, Cape Town Observatory, was elected a Corresponding Member, and Messrs. Charles Daley, Jas. Steel, and W. Watson Rutherford were elected Ordinary Members.

Mr. ISAAC ROBERTS, F.R.A.S., exhibited a model to illustrate the motions of the Satellites of Jupiter.

Rev. THOS. P. KIRKMAN, M.A., F.R.S., presented a Paper* "On the 24 Edra having only Triad Summits, and for Faces only Pentagons, Hexagons, Heptagons, and Octagons which are reducible to the regular Dodecahedron," with tables of results by the method expounded in his former paper on this subject.†

A letter from Professor MacCunn was read, announcing the proposed foundation of a Scholarship in Owens College, Manchester, for Economical Research, in honour of the late Professor Jevons.

Dr. NEVINS read a second communication on the proposed Jordan Valley Canal, with special reference to the rate at which the waters of the Mediterranean would flow into the Canal. The subject again led to much discussion in which Messrs. Beloe, Walthew, and Symes took part.

Dr. IMLACH then read a Paper on "Mental Inheritance," which also led to considerable discussion, supported by Messrs. Rennie, Ball, Higgins, MacCunn, Carter, Hayward, Kirkman, Drysdale, Stern, Shearer, and the President.

* See page 55. † See vol. xxxiii.

FOURTH ORDINARY MEETING.

Royal Institution, November 26th, 1883.

RICHARD STEEL, President, in the Chair.

Messrs. R. J. Harvey Gibson, M.A., W. P. Sinclair, and Joseph Ismay were elected Ordinary Members.

Mr. T. J. Moore reported the following:—

ADDITIONS TO THE LIVERPOOL FREE PUBLIC MUSEUM FROM THE FISHERIES EXHIBITION, LONDON.

Menhaden, &c.

Life-sized Models, coloured from nature, of the Menhaden (*Clupea Menhaden* of Mitchell, *Brevoortia Menhaden* of Gill); White Fish (*Coregonus clupeiformis*); and Spanish Mackerel (*Scomberomorus maculatus*); in illustration of the method adopted for the representation of the principal fishes of the United States; received from Professor Spencer F. Baird, Commissioner of Fish and Fisheries.

The Menhaden is one of the sixty species of the herring tribe known to naturalists.

Most of these are more or less useful to man; but Dr. Gunther states that a few tropical species acquire, probably from their food, poisonous properties sufficient to endanger the lives of persons eating them. (Gunther's *Study of Fishes*, p. 658.)

The following extracts show the great importance of this fish, they are taken from the "Fishery Industries of the United States, by G. Brown Goode, M.A., Assistant Director of the United States National Museum, and Commissioner to the International Fisheries Exhibition of 1883," one of the printed Papers of the Conferences held in connection with the Exhibition.

MENHADEN.—This fish has become within the last few years of the highest commercial importance.

"Twenty-five years ago it was esteemed of small value, but now, as a source of oil, the Menhaden is of more importance than any other marine creature, whales included. Its annual yield of oil exceeds that obtained by the Americans from the whale fishery by about 200,000 gallons; and in 1874, did not fall far short of all the whale oil, all the cod oil, and all the seal oil, made in America.

In 1878, the American Menhaden oil and guano industry employed capital amounting to 2,350,000 dollars, 3,337 men, 64 steamers, 279 sailing vessels, and consumed about 770,000,000 of the fish. There were 56 factories, producing *in a poor year* 1,392,000 gallons of oil, valued at 450,000 dollars, and 55,000 tons of crude guano, valued at 600,000 dollars.

The refuse of the oil factory supplied a material of much value for manures. As a base for nitrogen it enters largely into the composition of most of the manufactured fertilizers. The amount of nitrogen derived from this source in 1875 was estimated as equal to that contained in 60,000,000 lbs. of Peruvian guano, the value of which would not have been far from 2,000,000 dollars. The yield of the Menhaden fishery in pounds is probably three times as great as that of any other fishery of the United States; and if the Menhaden were to forsake the American shores, it would probably reduce all the other sea-fisheries to at least one-fourth their present extent owing to its extensive use as bait. In 1872 a large business sprung up for canning them in oil, like sardines, but the herring has since been found preferable.

EUROPEAN BEAVER.

Mr. MOORE also exhibited a specimen of the *European Beaver*, purchased in the Russian Court of the Exhibition.

The European Beaver formerly existed in Britain. Pennant, the eminent naturalist, says it was found in Wales as late as the twelfth century.

Its remains, skulls, &c., are found from time to time in the Fen districts of England.

On the continent of Europe, Beavers are still found, though in greatly reduced numbers, in the Danube, among the willow plantations, where they are strictly preserved. They are nearly or quite exterminated in Scandinavia, but are found sparingly in Russia and Poland.

There was a small colony at Magdeburg, on the river Elbe, fifty years ago, of no more than fifteen or twenty individuals; but these few executed all the laborious works of a much more extensive society.

The European Beaver was said to burrow only, and to live either singly or in pairs, and the American Beaver to live in large colonies, executing extensive works, and to be distinct in kind.

It is now believed that they are varieties only of one and the same species; that the American Beaver when crowded out by man will take to the more solitary habits of his European brother; while the European Beaver, where there is scope for his energies, will display the building instincts of the American. An exhaustive book on *The American Beaver and his Works*, by Lewis H. Morgan, was published by Lippincotts, of Philadelphia, in 1868. It contains a full comparison of the European Beaver with the American.

Mr. Moore also exhibited an Eared Seal and other specimens from the Chilian Commission; specimens of Australian fish, etc., from the New South Wales Commission, per Mr. E. P. Ramsay, F.L.S., Secretary; Shells, Crustacea, etc. from India, per Dr. Francis Day, Special Commissioner from India; and selections from a collection of sixty named

species of small Marine Crustacea from the Arctic Coasts of Norway, named, prepared, and mounted, chiefly during the long Arctic night, by Sparre Schneider, of the Tromso Museum, the most northern museum in the world.

Rev. H. H. Higgins, M.A., read the first part of a Paper on Museums of Natural History.*

Dr. Shearer also read a short Paper on "The Insanity of the Poet Cowper," after which Professor Herdman contributed some "Remarks on the Theory of Heredity." †

FIFTH ORDINARY MEETING.

Royal Institution, December 10th, 1883.

RICHARD STEEL, President, in the Chair.

Miss Alice Heath and Messrs. W. J. Davey and Jas. Hargreaves, F.C.S., F.A.S., were elected Ordinary Members.

Professor Herdman exhibited models of Coral Reefs, Islands and Lagoons, adapted for educational purposes.

Dr. Carter exhibited a number of diagrams, enlarged from the fever maps published by Drs. Trench and Taylor respectively. These maps shewed the incidence of mortality from typhus fever during the epidemic years 1865 and 1882, and from them it was obvious that, in every locality where improvements had been carried out according to the principles laid down by Dr. Trench, a most marked diminution in the mortality had occurred, while there had been no corresponding diminution in neighbouring parts which, owing to their not being considered quite so bad, had not been improved. "The one principle," said Dr. Trench, "which chiefly regulated the plans of improvement, was

* See page 183. † See page 77.

a desire to obtain the greatest amount of direct ventilation, and of the ingress of air and light to the houses of courts, at the least sacrifice of property." One of the blocks of property selected for improvement, owing to its being a typical fever centre, was that which included Addison, Bispham, Henry Edward, Adlington, Lace and Hodson Streets, with adjacent parts of Great Crosshall Street and Marybone. In 1865, there were seventy-six deaths in this limited locality, while in 1882, the date of the next epidemic, there were only eleven. The circumstances that render the difference remarkable are that the habits of the inhabitants were precisely the same in the two years, and that a high mortality was maintained in 1882 in the surrounding streets which had not been improved. The very next streets to those within the improved area had a high death-rate from fever in 1882. If this example had been a solitary one, Dr. Carter considered that it would have justified a large expenditure on the part of the sanitary authority in the improvement of insanitary dwellings, but when, without a single exception, every one of the many streets or districts that had been improved shewed an analagous result, he held that the appeal for action should be irresistible, as the cumulative force of the successive examples appealed to the mind with the force of demonstration. He drew attention to the last recorded words of Dr. Trench, in which, shortly before his death, he urged the necessity of structural alterations in a large parallelogram of streets at the south end of the city, including Mann, Wolfe, Henderson and neighbouring streets, and pointed out the extraordinary contrast between the heavy death-rate from typhus fever during 1882, in the general mass of this property, and the complete immunity from mortality of one small block within it, which in consequence of its exceptional badness had alone been improved.

Mr. GUTHRIE exhibited a series of enlarged copies of drawings made by Thought Transference, and explained the mode in which they had been produced.

A Paper was read by Mr. R. McLINTOCK, on "The Early Life of Heinrich Heine." *

SIXTH ORDINARY MEETING.

ROYAL INSTITUTION, January 7th, 1884.

RICHARD STEEL, PRESIDENT, in the Chair.

Miss Fanny Calder and Miss Cradock, L.K.Q.C.P.I., and Messrs. Wm. Buchanan, John Currie, J. M. Williams and W. E. Sharp were elected Ordinary Members.

A Paper was then read by Mr. C. H. BELOE on the Flow of Water in Open Channels, in connection with the discussions on the proposed Jordan Valley Canal, raised by Dr. Nevins, at the Second Meeting. The following is an abstract of the Paper :—

THE FLOW OF WATER IN OPEN CHANNELS.

BY CHARLES H. BELOE, M. INST. C.E.

IN order to determine the quantity of water that can be conveyed from one point to another, by means of a channel of a given area of cross section, there are three principal elements to be taken into consideration.

1st.—The difference in level between the source of supply and the place to be supplied, or, as it is usually called, the available *head* of water.

2nd.—The horizontal distance between the source and and the destination of the water, or the length of the channel.

* See page 105.

3rd.—The materials of which the channel, and especially the sides of the channel, are composed.

The most expeditious manner of conveying water from one level to another, supposing the horizontal distance to be "nil," is over a weir or waterfall.

The formula given by Beardmore for calculating the discharge of water for each foot in width of a weir is as follows:—

$$D = 214 \sqrt{H^3}$$

where D is the discharge in cubic feet per minute, and H the true height from the top edge of the sill of the weir to the surface of the water where it is at rest, or nearly so.

The quantity of water supplied to this city from Rivington is measured by a weir of this description; and I constructed a similar weir across the river Wien, in order to determine the dry weather flow of that river where it enters the city of Vienna.

I will now consider a case where there is a considerable horizontal distance between the source of supply and the place to be supplied, consequently a channel is required to convey the water from one point to the other.

The subject of the flow of water through *large* open channels, such as rivers or ship canals, has only recently received much attention, the experiments having been previously confined to small orifices, short and small pipes, and velocities in troughs eighteen inches wide; but the experiments of d'Arcy in 1856, the operations of Captains Humphreys and Abbott on the Mississippi in 1858, and the experiments of Bazin in 1865, led the way to a more accurate knowledge of the discharges and velocities of open channels.

The general formula for the discharge of open channels, given in Jackson's *Hydraulic Manual*, is as follows:—

$$V = c \times 100 \, (R\,S)^{\frac{1}{2}}$$

where c is a variable experimental co-efficient depending upon the conditions, dimensions, and hydraulic slope of the channel; its value varies in extreme conditions from ·25 to about 2·00.

R = Mean hydraulic radius.

S = Hydraulic slope in terms of its sine.

The formula given by Beardmore for calculating the discharge of open channels is as follows :—

$$V = \sqrt{(H \times 2F) \times 55}$$

where V = mean velocity of the stream in feet per minute.

H = hydraulic mean depth in feet.

F = the fall of the channel in feet per mile.

Beardmore states that *the velocity and discharge vary as the square root of the fall,* consequently *half the discharge or velocity of any given fall* will be the discharge or velocity for *one-fourth that fall;* or, *vice versa, for the discharge or velocity of* FOUR *times* any given fall per mile, take TWICE the discharge or velocity of such fall.

That is to say, the discharge of a stream having a velocity of *four* miles per hour, will be TWICE the discharge of a stream having a velocity of one mile per hour.

An inclined channel falling at the rate of five feet per mile, with a length of fifty miles, by Beardmore's formula would give a velocity of 8·55 miles per hour, and would discharge at its termination a quantity of water equal to the whole area of the canal, which would run constantly full, or 83,661 cube yards per minute, as compared with 130,222 cube yards per minute discharged over a weir, thus showing the retarding influence of a canal even with the great inclination of five feet per mile.

In designing a channel for the conveyance of water, the velocity of the current has to be determined, not only by the available fall but by the nature of the materials of which the channel is composed; and in the case of a ship canal, the

velocity of the current must not be so great as to interfere with the progress of ships. In the Panama Canal the level of the Pacific Ocean has been ascertained to be so much below that of the Atlantic, that if a uniform inclination were given to the canal there would be a current in it of five knots an hour, which would be a great impediment to navigation. It has therefore been decided to construct locks at the Pacific end of the canal and to make the latter nearly level.

I now come to the consideration of the flow of water in a long open channel, perfectly level, communicating with the sea at one end, and having a perfectly free discharge at the other.

If a canal is perfectly level, and the water at both ends is at the same level, there would be *no flow whatever;* but if one end of the canal is open and discharges over a precipice, there undoubtedly would be a flow through it.

If a perfectly level trough, closed at both ends and filled with water, has the ends suddenly removed, the water will flow out at both ends simultaneously, and the particles of water in the middle of the trough will be the last to be set in motion, the surface of the water after the removal of the ends assuming the form of two inclined planes, or, more correctly speaking, of two parabolic curves.

As Rankin says, "in order to acquire velocity from a state of rest, a fluid particle must pass from a place of *greater total head* to a place of LESS total head." This it would do in the case of the level trough when the ends are removed.

The level canal with the open end may be compared with one-half of the trough, the only difference being that the trough would soon become empty and the velocity of discharge decrease as the depth of water diminished, whereas the canal would be continually supplied from the sea, and the velocity of discharge would remain constant.

It is evident that there must be a flow of water along the canal to replace the quantity discharged at its termination, and as the *bottom* of the canal is level, the *surface* of the water must assume an inclined form, otherwise there would be no flow, as there cannot be any flow where the pressure is uniform, as would be the case if the bottom of the canal and the surface of the water were both level.

It is impossible to calculate the fall which would take place in the surface of the water of a level canal without knowing the nature of the materials of which the canal is composed, and no formula with which I am acquainted gives the exact inclination, even if this information was procurable.

In order to calculate the discharge of the level canal with the open end, I have assumed that the depth of water at its termination would be ten feet. This with a length of fifty miles would give an inclination to the surface of the water 0·4 feet per mile.

It would be wrong to calculate the discharge by taking the area of the water in the canal at its termination, which would be $100 \times 10 = 1{,}000$ square feet, and to multiply that area by the velocity due to the inclination, as that process of calculation would only deal with the upper layer of water, ten feet deep for the whole length of the canal, and would omit the wedge-shaped piece of water lying underneath the upper layer. I have, therefore, assumed that the average fall of this wedge would be a mean between the inclination of the surface and the level bottom, and this mean inclination is one-half of the rate of inclination of the surface, viz., 0·2 feet per mile.

In working out Eylelwein's formula for

$$v = \sqrt{(H \times 2F)} \times 55$$

I have taken H, or the hydraulic mean depth, at the middle of the canal, and not at its termination, and for F, or the fall

in feet per mile, I have taken the sum of the fall of the top layer of water, and of the mean inclination of the underlying wedge or 0·4 feet + 0·2 feet = 0·6 feet per mile.

The velocity obtained is 227·7 feet per minute, and this multiplied by the area of the cross section of the canal at its termination, gives a discharge of 8433 cube yards per minute.

If the depth of water at the termination of the canal is reduced to two feet, the quantity of water delivered by the canal would be 1837 cube yards per minute, the surface inclination being increased by the reduction of depth at the termination to 0·56 feet per mile. In round numbers, therefore, I estimate the discharge of the level canal, fifty miles long, to be 2,000 cube yards per minute, as compared with a discharge of 130,222 cube yards per minute over a weir of the same width as the canal.

The following are then the results of my calculations:—

Discharge of an open Canal 100 feet wide × 30 feet deep.

	Discharge in cube yards per minute.	
	Fall 1 foot per mile.	Fall 5 feet per mile.
Jackson's Formula for Brickwork or cut stone - -	66,076	141,536
„ „ „ Rubble - -	50,645	111,469
„ „ „ Clean Earthen Bed	38,379	82,047
Beardmore's Tables (Table 5) - - -	39,701	88,777
Eylelwein's Formula - - - -	37,424	83,661
Average of three last results - -	38,501	84,828

Average increase in discharge owing to increased inclination $2\frac{1}{4}$ times.

		Cube yards per minute.
Discharge over weir	- - - - - -	130,222
,, of canal, inclined 5 feet per mile	-	84,828
,, ,, ,, 1 foot	- -	38,501
Discharge of level canal, with 10 feet at its termination	- - - - - - - -	8,433
Discharge of level canal, with 2 feet at its termination	- - - - - - - -	1,837

In conclusion, I have endeavoured to place before you my reason for stating that it was impossible for me to check the calculations made by Dr. Nevins as to the period required to fill the valley of the Jordan unless I knew the nature of the material of which the proposed canal would be made, and also the inclination that would be given to the canal, as I could not agree with the statement made by Dr. Nevins that "the time occupied would be substantially if not actually the same whether the canal was level or inclined, provided the exit end of the canal is entirely unobstructed."

A Paper was then read by Miss Jessie Macgregor, on "Scandinavian Mythology from the Picturesque Side." *

SEVENTH ORDINARY MEETING.

Royal Institution, January 21st, 1884.

RICHARD STEEL, President, in the Chair.

Dr. Hope, Mr. Edward Nicholson, F.C.S., F.I.C., and the Rev. J. Polack, B.A., were elected Ordinary Members.

* See page 129.

The PRESIDENT stated that the Council had received the resignation of Mr. Johnson, the Honorary Treasurer. He then moved that the best thanks of this Society be given to Mr. Johnson, for the valuable services he had rendered in the office of Treasurer for the last eleven years. The motion was seconded by the Rev. H. H. HIGGINS, M.A., and carried unanimously.

It was then moved by the Rev. H. H. HIGGINS, M.A., seconded by Sir J. A. PICTON, and carried, that the Honorary Secretary be requested to act as Treasurer until the vacant office be duly filled up.

The Rev. H. H. HIGGINS exhibited, and made remarks upon, a case containing about fifty selected species of named Lepidoptera from West Africa, from the collection of Miss Marian Swanzy, and presented by her to the Free Public Museum, per Mr. S. Leigh-Gregson.

Mr. ISAAC ROBERTS, F.R.A.S., reported his observations of the Comet (*Pons Brooke*), made the previous evening, and was followed by Mr. JOHNSON, F.R.A.S., with a further account of it.

A Paper was then read by the Rev. S. FLETCHER WILLIAMS, on "The Reformation in its Relation to English Literature." *

EIGHTH ORDINARY MEETING.

ROYAL INSTITUTION, February 4th, 1884.

RICHARD STEEL, PRESIDENT, in the Chair.

Mr. T. J. MOORE exhibited, from the Comparative Osteological Collection of the Free Public Museum, a small series

* See page 255.

of Mammalian Cervical Vertebræ, including those of Man, the Gorilla, young Elephant, young Giraffe, and Porpoise.

Rev. H. H. Higgins, M.A., read the second part of a Paper on "Museums of Natural History,"* and was followed by Dr. Hayward, with a Paper on "Modification of Hereditary Transmission by Educational and Mental Influences." †

NINTH ORDINARY MEETING.

Royal Institution, February 18th, 1884.

RICHARD STEEL, President, in the Chair.

Mr. John Rutherford, LL.B., was elected an Ordinary Member.

The Rev. H. H. Higgins, M.A., exhibited four specimens of Coral from the Java Sea, brought to Liverpool by Capt. Anderson, of the Siamese barque "Koon Kramorn," reported to be from the scene of the late earthquakes in the Bay of Sunda, and temporarily deposited in the Free Public Museum by Capt. Findlay, of the firm of Findlay and Bigland, Bath Street, Prince's Dock.

Mr. H. Longuet Higgins read a Paper on "Communism, Ancient and Modern." ‡

TENTH ORDINARY MEETING.

Royal Institution, March 3rd, 1884.

RICHARD STEEL, President, in the Chair.

Rev. H. H. Higgins, M.A., exhibited a handkerchief

* See page 183. † See page 93. ‡ See page 227.

which had been perforated by growing blades of grass while exposed for bleaching on a newly mown lawn.

A Paper was read by Dr. NEVINS, on "The History of the Introduction of Peruvian Bark Trees (Cinchonas) into India." *

ELEVENTH ORDINARY MEETING.

ROYAL INSTITUTION, March 17th, 1884.

RICHARD STEEL, PRESIDENT, in the Chair.

The Rev. H. H. HIGGINS, M.A., exhibited a selection of about thirty species of *Protozoa, Tunicata, Medusæ, Pyrosoma,* and other marine specimens, chiefly Invertebrates, of the Bay of Naples, beautifully mounted and displayed in spirit, and recently purchased for the Free Public Museum from Dr. Dohrn's Zoological Station at Naples.

A Paper was read on "The Possible Effects of the Present System of Elementary Education in this Country upon the Health of the Community," by Mr. J. MUIR HOWIE, M.B.

TWELFTH ORDINARY MEETING.

ROYAL INSTITUTION, March 31st, 1884.

RICHARD STEEL, PRESIDENT, in the Chair.

The Rev. H. Burman was elected an Ordinary Member.

The Rev. H. H. HIGGINS, M.A., exhibited a small cabinet, fitted up with specimens, to be used with others as a Circu-

* See page 287.

lating Museum in the public schools of the city, under the sanction of the Library and Museum Committee.

Dr. Carter exhibited a number of germinating Peas that had been planted at varying depths beneath the surface of the soil. The effect of increasing the depth seemed to be a shortening of the root and an increase in the length of the plumule. In every case the soil was broken through by the crown of an arch formed by the bending of the cotyledons on the plumule. These latter never assumed a vertical position, nor became expanded until the gradual ascent of the arch by the elongation of the plumule had cleared them of the soil.

Mr. Joseph Ismay read a Paper on "Light and Electricity."

THIRTEENTH ORDINARY MEETING.

Royal Institution, April 7th, 1884.

RICHARD STEEL, President, in the Chair.

Rev. W. G. Lawes, New Guinea, and Messrs. A. W. Crawford, Oakland, California, John Greenwood, Mining Engineer, Melbourne, and Robert Abraham English, Simla, were elected Corresponding Members.

Captain G. Griffith Jones, Barque "Hermine," was elected an Associate.

Dr. Black exhibited a new Ship Anemometer, designed by himself, and read a short Paper upon its construction and use.*

The Rev. H. H. Higgins exhibited a piece of a wood pile, which was bored through in every part by the Ship

* See page 223.

Worm (*Teredo*), in the course of eleven months at Mr. Alfred Holt's Wharf, Lankat, Sumatra, where it was put down in December, 1882. The specimen measured twenty inches in length by ten inches in diameter; and had been presented to the Free Public Museum by Mr. Alfred Holt, whose Wharf had suffered much damage.

References were made to the death of Mr. Leigh-Gregson, Honorary Registrar, and one of the chief supporters of the Liverpool School of Science.

Mr. JOSIAH MARPLES read a Paper on "Jane, Queen of England—her Life and Times." *

FOURTEENTH ORDINARY MEETING.

ROYAL INSTITUTION, April 28th, 1884.

RICHARD STEEL, PRESIDENT, in the Chair.

Rev. H. H. HIGGINS, M.A., read the Third Part of his Paper on "Museums of Natural History." †

Mr. R. J. HARVEY GIBSON, M.A., read a Paper on "The Fauna and Flora of Oceanic Isles." ‡

Professor HERDMAN, D.Sc., F.L.S., gave an account, illustrated by diagrams, of the remarkable Marine Station for Scientific Research which has recently been established at Granton, on the Firth of Forth, and in which he had been carrying on some Biological investigations during the last month. The Station is under the direction of Mr. John Murray, of the "Challenger" Office, Edinburgh.

A Paper was read "On the Cause of Rot in Sheep," by JOHN SIBLEY HICKS, F.R.C.S., F.L.S.

The Rev. H. H. HIGGINS exhibited a Mud-daubing

* See page 155. † See page 183. ‡ See page 241.

Wasp's Nest (genus *Pelopæus*), taken from a clock brought to Liverpool from the West Indies for repair, the works of which were stopped by it. The nest was presented to the Free Public Museum by Mr. Henry J. Nicholls, of Liverpool.

Mr. T. J. Moore, Cor. Mem. Z.S.L., exhibited the following specimens, recently added to the Free Public Museum :—

The skull and jaws of an adult Ceylon Elephant, without tusks, presented by Mr. Hugh Ledward, Colombo, Ceylon, per Mr. J. A. Ledward, of Liverpool.

A *large* upper molar of the Indian Elephant; the tooth is the sixth and last on the left side, measures eight inches in length, twelve inches in height, and is four inches broad, with eleven, or less than one-half of, the plates as yet in functional use; weight seventeen pounds ten ounces.

A *small* (second) molar of young Indian Elephant. This tooth was presented by Mr. William Hewitt, B.Sc., Science Demonstrator of the Liverpool Board Schools. It measures only two and a half inches in length, and weighs three and three-quarter ounces.

A mounted skeleton of the Tuatera Lizard (*Sphenodon punctatus*, Gray), from New Zealand.

Specimens of seventy-two species of British Polyzoa, mounted on slides for microscopical examination and study; prepared and presented by Miss E. C. Jelly.

NOTE ON A FURTHER LOCAL ATTEMPT TO NATURALIZE THE AMERICAN CLAM, *VENUS MERCENARIA*.

By THOMAS J. MOORE,
Curator of the Liverpool Free Public Museum.

In the month of May, 1883, a barrel of living specimens of the Quahaug or American Hard-Clam, *Venus mercenaria*,

was sent to the Museum, from New York, by Captain J. H. Mortimer, Premier Associate of the Society, through the kind offices of Captain Hamilton Perry, R.M.S.S. "Britannic," for the purpose of laying down on the neighbouring shores with a view to naturalization. A few specimens were placed in the Museum Aquaria, and, notwithstanding the extremely limited accommodation afforded by the small glass vessels in which they were placed (only twelve inches in diameter with three inches depth of sand), several are still living,* and prove that the Molluscs were in healthy and favourable condition on arrival.

In reference to the planting of the Clams, Mr. F. P. Marrat kindly accompanied me, on the 19th May, to the Hoylake shore, at low water, with a view to distributing a portion there, but not thinking it sufficiently promising, we contented ourselves with casting a number into the stream beyond the bridge above the Great Float, or Birkenhead line of Docks.

Subsequently I cast a larger number of Clams into the Dee, near Queen's Ferry, also at low water; and, to multiply chances, placed a few score at the disposal of Mr. Alfred O. Walker, of Chester, and others I gave to Mr. Shrubsole, of Chester, and both gentlemen placed them in favourable parts of the Dee.

The above facts are thus placed on record, in case of the experiment proving successful, and, also, as due to Captain Mortimer's liberality and zeal in providing the supply of this highly esteemed American Mollusc.

Captain Mortimer similarly provided the material for the first attempt, particulars of which are recorded in the *Proceedings* of the Society, February 22nd, 1869; vol. xxiii, pp. 192-3.

* And are yet alive in September, 1884, after sixteen months' confinement in the above limited space.—T. J. M.

The discovery of several single valves of *Venus mercenaria* off Hilbre Island, at low water, by Mr. Shrubsole, during the Excursion of the Liverpool Naturalists' Field Club, in September, 1882, led to the supposition that they indicated the success of that first experiment. Further search and wider enquiry, however, have failed to prove this, and no evidence has hitherto come to hand of any success resulting from that experiment.

MIND IN MAN AND THE LOWER ANIMALS.

By RICHARD STEEL.

The subject which I am about to bring before you this evening is one which must from the earliest times have suggested itself in some form to the human race. Next to himself and his own wants, the attention of primæval man would necessarily be attracted to the many types of animal life which surrounded him; and the first steps which he made towards scientific knowledge must have consisted in a study of the habits and natural history of the various beings with which the earth, air, and sea around him were peopled.

The interest which man thus showed was speedily reciprocated. The dog, in all probability his oldest as it has ever since been his most faithful friend, joined him in his predatory expeditions, and the ancestral friendship of the human and canine races was founded upon mutual advances and mutual service. The sheep, the ox, and the horse soon grazed around the place of his abode, and the ancient dweller in the plains of Asia, as his eye rested on the living creatures about him, must often have asked himself the same question which I propose to you to-night. *Is there any essential difference between man and the brute other than those of physical form and habits? Is the mind, of whose stirrings we are conscious, a something different in kind as well as in degree from the intelligence of creatures whose life-history presents so many points of resemblance to our own, and with some of which, in truth, our own development as a race has been so inseparably bound up?*

I need hardly say at the outset that the question just stated has been often answered, and answered in both senses. Professor Büchner, an ardent advocate of the view that there is no such essential difference,* cites Plutarch, Galen, and Celsus, as being of the same opinion as himself. Amongst more modern writers, Lessing, † Humboldt, Charles Darwin, and Herbert Spencer may certainly be reckoned as being of the same way of thinking. And in evidence of the widely extended prevalence of similar views amongst great masses of mankind outside of the charmed circle of authors and scientists, we need but call to mind the doctrine of the transmigration of souls held by many millions of the human race, past and present, a doctrine which clearly embraces in its sweep the same conception.

In spite however of all this weight of judgment, learned and unlearned, it is an evident fact that the general opinion of modern civilised life is to a contrary effect. The extreme view promulgated by Descartes, that the lower animals are mere automata, does not indeed meet with frequent acceptance, but it is nevertheless quite in common vogue to attribute the intelligence of man to reason, and that of the brute exclusively to instinct. With such thinkers all controversy upon the point with which we are dealing is shelved by the invention of a phrase, and hence it follows that the epigram, "Reason in man is instinct in the brute," when divested of its inherent irony, expresses very exactly the view held by many persons in the present day. The question being therefore as much an open one as ever it was, I propose to deal with it in a manner which will, I hope, present some elements of novelty, and which in any case

* *Mind in Animals.* London, 1880.

† Lessing believed in the pre-existence of the soul and metempsychosis; "the first and oldest opinion," he says, "is in matters of speculation always the most probable, because common sense immediately hit upon it."

appears to me to indicate the right direction from which it should be approached.

In the first place, then, we must remark that the state of verbal truce already alluded to, obtained by establishing a convenient distinction between reason and instinct, occasionally broken in upon before as it had been by scientific skirmishers, was still more rudely shaken of late years by the publication of Mr. Darwin's great book on the *Origin of Species*. That work established a new point of departure in reference to many subjects, and made upon the future of science and of thought an impress the full effect of which it will be for some future generation to measure. We have only to do, however, to-night with the Darwinian theory in so far as it bears upon our enquiry, and it is evident that in this regard it sets up the following important presumption. The Darwinian hypothesis represents man, so far as his physical existence is concerned, as being simply the final term in a long series of slight modifications of structure which by their accumulated effect bridge over the chasm which separates him from the most rudimentary forms of life. If this is a true account of the genesis of humanity, it follows that there is a strong probability, in the absence of evidence to the contrary, that man's intellectual being is also the result of a similar evolution, and that in regard to it he may assert superiority indeed, but not that essential difference of mental constitution which is often claimed for him. Such is, in point of fact, the conclusion arrived at by the great naturalist to whom I have just referred.*

It is possible, however, to overestimate the force of such considerations as these. An *a priori* presumption of the nature just stated, should not be regarded as, *per se*, conclusive, even by those who accept the Darwinian law as an article of their scientific faith. It should serve rather to

* *Descent of Man*, ch. i.

suggest further enquiry than to determine the issue. In my address to-night I propose, therefore, to consider the question in its more general aspect, and to enquire whether there is other and more definite ground for believing that the mind of man and that of the lower animals is essentially the same in its constitution.

For the purpose, then, of this enquiry, as I propose to conduct it, it is absolutely essential that we should start with a working definition of the term *mind*. There is probably no word in common use, and the meaning of which is so little open to dispute, which is at the same time so difficult to define explicitly. A recent writer, whose claims to high rank as a philosopher are generally admitted, Mr. Herbert Spencer, tells us for example that mind is certainly in some cases, probably in all, resolvable into nervous shocks, and that it is known to the possessor of it as a circumscribed aggregate of activities.* But elucidations of this sort are not convenient for less elevated discussions than those of the eminent synthetic philosopher; and I shall rather take it, therefore, that we mean and connote by the term mind all those conscious phenomena of animate existence which we are not able to associate clearly with corresponding physical phenomena standing to them in a direct causal relation. It may be, and indeed is not at all improbable, that Professor Huxley † and other scientists are right in believing that for every conscious idea of man or brute there is a corresponding physiological and molecular change. But if such a proposition be admitted without reserve, the question with which we are dealing would to many minds be an open question no

* *Principles of Psychology*, pp. 156, 159. Mr. Spencer also describes mind as being composed of feelings, and the relation between feelings.—*Ibid*, p. 210.

† See article in *Fortnightly Review*, November, 1874.

longer. It could only be answered by them in the negative. For if mind is merely a function and derivative of physiological and molecular change in both men and animals, it follows that the mind of the latter must stand in the same relation to the mind of the former as does the physiological system of the one to that of the other. But Darwinians believe that those physiological systems vary only in degree of development; and, therefore, in their view, if we adopt the molecular theory above referred to, the respective minds can vary only in degree of development also.

We must assume, therefore, for the sake of setting the general question at large, that mind is something separate from and independent of physiological constitution. If this supposition is valid, it is an indispensable postulate to our discussion. If it is invalid, it still leaves such collateral importance as the discussion may possess untouched and unimpaired.

The phenomena of human existence, then, which are grouped together under the general term of mind, are variously classified and divided by the many writers who have dealt with such matters. Thus, we have mind analysed by some into the three grand divisions of the Intellect, the Emotions, and the Will. We have, again, the elaborate psychological system devised by the phrenologists, under which the intellectual faculties are discriminated into various modes of intellect, and the emotions into different modes of feeling and of passion. Or, again, we may take the simple and, so far as it goes, scientific division of the mental faculties for which Aristotle was originally responsible. He considered mind as consisting of Judgment, Imagination, and Memory, using the term mind of course in a more limited sense than is now usual, as synonymous in fact with what we generally term Intellect. In order to complete such a

division for our purpose, we have simply to add to it the Emotions and the Will, in order to be exhaustive. An analysis of mind upon any principle might, of course, be adopted as the basis of an enquiry such as that in which we are engaged, and the result reached would necessarily be the same, if the process of comparison were properly conducted. But there is much to be said in favour of simplicity of treatment in an address which cannot be conveniently allowed to extend beyond a moderate length; and thus, both upon the grounds of accuracy and perspicuity, I will take the above extension of the Aristotelian division as my starting-point.

Assuming, then, that the human mind may be regarded as consisting of Judgment, Imagination, Memory, the Emotions, and the Will, it becomes necessary to divide the first of these terms into two. Judgment may clearly be regarded as consisting of two separate elements—Perception and the Reasoning faculty. We thus get for our final enumeration of the mental powers, Perception, Memory, Imagination, the Emotions, the Will, and the Reasoning faculty, and have now to consider how the lower creation compares with mankind in reference to these various modes of the mental existence.

We take then Perception first. It is clear at the outset that there is no essential difference between men and animals, so far as the simple acts of sense are concerned. Some of the lower forms of life do not, indeed, possess certain senses. But the higher forms of the brute creation possess as many as man himself. The dog and many other creatures far surpass him in acuteness of smell; the bird in keenness of vision and sharpness of observation; the deer and other quadrupeds have sharper hearing. It is probable that the sense of feeling or touch is the only one in the exceptional sensitiveness of which man stands without a

rival. But even in the case of touch, his superiority is a mere question of degree.

Even as regards the more recondite and complex perceptions—such as that of beauty—man, though he probably excels all other animated beings with which we are acquainted, does not stand by any means alone. It is known, for example, that many creatures appreciate beauty of sound. In India there are snakes, known as dancing snakes, which, by their movements in concert with music, display a knowledge of time and tune. They are enticed from their nests by music in the so-called process of snake charming. Büchner tells us that spiders evince a similar susceptibility. He tells us that if an instrument be played gently in the room where they are present, they approach as close as possible to it and the player. They are often seen to let themselves down by a thread from the ceiling of the room for this purpose; as soon, however, as the music becomes noisy, they run back to their nests. We have evidence, again, in the songs of birds to their mates, and in the fact that in some species the female consorts by preference with the best singer, that our feathered friends have a keen ear for melody. And everyone must have noticed how the horses of military men are affected by the strains of martial music.*

So again, many creatures clearly derive a gratification to the eye from colour and form, which is quite correspondent, so far as it goes, to human appreciation of the same modes of beauty. It is a perception of this kind which presides over the pairing of many creatures, and which makes the flowers of the field an attraction to insect life. A certain degree of

* Pliny attributes to this susceptibility of the horse the defeat of the Sybarites by the Crotonitae. During a pitched battle, the trumpets of the latter sounded in such a manner as to cause the horses of the Sybarite cavalry to fall to dancing, the result being that their riders were cut to pieces.

utilitarianism, no doubt, underlies the pleasure with which, for example, the humble bee views the beauty of the red clover amongst the grass; but there can be no doubt that a similar subordinate idea of utility underlies the sentiment with which a human being looks upon a field of grain ready for the sickle, or with which a judge of domestic cattle, sheep, and pigs, reckons up the points of farm-yard æstheticism.

Even so far as the still more abstract idea of right and wrong is concerned, it is certain that many, if not all, animals are possessed of it in some degree. Without attempting to investigate their ethical foundation, we may safely assert that all notions of right and wrong are based upon the idea of duty. But all the social insects—the ant, the bee, and so forth—have the very clearest conception of duty to the communities of which they form part. They work till completely exhausted for the general good. They are prepared to sacrifice their lives for the general security. Amongst domestic animals, the dog or cat detected in some petty theft, betrays its consciousness of guilt as readily as does the human being. Birds have amongst themselves an ethical code which defines certain rights of property in respect of nests and so forth, which it is wrong to transgress, and the transgression of which has been known in a recorded case to entail summary retribution. So that, in fine, taking the faculty of perception both in its simpler and more general aspects, it is evident that, so far as it at least is concerned, man's claim to be something entirely different in his powers from the lower animals must be peremptorily dismissed.

The form of mind which comes next to be considered, in natural sequence, is that of Memory. How stands the comparison between man and the brute in this regard? We find at once, upon the most superficial examination of the facts, that all the higher animals possess well-developed memories,

and that the presence of memory may be directly inferred from the behaviour of even very low organisms. Man, no doubt, possesses a more copious memory than that of any other creature. Still, this implies only a greater extension of a faculty in itself the same as is enjoyed and made use of by the dog, the horse, and the bird. All these creatures remember their friends and know their enemies. They have a keen recollection of locality, as is admirably evidenced by those migratory birds which travel far and wide in their season, but nevertheless return with the utmost exactness to build their nests in the same spot as in former years. It is said that the horse never forgets a road he has once travelled, and all of us have heard of, and most of us have probably known, horses which persist in stopping at places of resort frequented by a former owner. It is told of the celebrated Kosciusko, that on one occasion he sent a messenger to call upon a friend, and for the purpose lent the messenger his horse. On his return, young Zeltner (the messenger) said that he never would ride the horse again unless he gave him his purse at the same time. Kosciusko enquiring what he meant, he answered, "As soon as a poor man on the road takes off his hat and asks charity, the horse immediately stands still, and will not stir till something is given to the petitioner; and as I had no money about me, I was obliged to feign giving something in order to satisfy the horse." *

Darwin tells us of a dog which recognised him after an interval of five years and two days and although a savage animal and averse to strangers followed him obediently after so great a lapse of time. † The memory of the dog was, however, well known in even the earliest historic times. A fine description in the *Odyssey* shows that this animal possessed, some 2,700 years ago, much the same high

* *Percy Anecdotes.*

† *Descent of Man.*

qualities in this and other respects which he possesses now. The lines describe an incident upon the return of Ulysses in disguise after twenty years' absence :—

> Thus, near the gates, conferring as they drew,
> Argus, the dog, his ancient master knew.
> * * * * *
> He knew his lord ; he knew and strove to meet ;
> In vain he strove to crawl, and kiss his feet ;
> Yet (all he could) his tail, his ears, his eyes,
> Salute his master and confess his joys.
> * * * * *
> The dog whom Fate had granted to behold
> His lord, when twenty tedious years had rolled,
> Takes a last look, and having seen him, dies;
> So closed for ever faithful Argus' eyes.

Not only however do animals remember sights—they recollect the other sense impressions, as, for example, sounds and smells. The latter gift is, in fact, indispensable to the self-preservation of many creatures, and will therefore be considered by many as a mere instinct, whatever that may be. But the same consideration does not apply to the recollection of sounds. Nearly all domestic animals understand much of what their master says. The magic word *rats* has only to be mentioned to an educated terrier in order to produce appropriate results. A more complete illustration of memory for sounds is furnished by talking birds. Parrots, for example, can repeat many sentences, and obviously connect them intelligently with certain subjects. I do not, of course, say that the parrot understands what it says in the same sense that the human being understands the same words, but the fact remains that its power of repeating at will the many complex sounds which go to form its vocabulary is conclusive evidence of its memory for sounds being *sui generis* with that evinced by humanity.

It may be said, however, that in man a very important department of memory is that by which he can recall past subjective states—that is to say, the internal feelings and ideas which have passed through his mind, and that the brute creation does not possess the same power. I admit the first proposition, but I demur to the second. The power of being able at will to recall past thoughts is undoubtedly a useful form of memory, but it does not by any means follow that no animals other than man are possessed of it. It appears to me rather that the fixed aversion to some persons and liking for others, which many animals show, must often be due to the voluntary recall of similar feelings experienced on some previous occasion.

Having thus seen that animals possess memory similar to that of man, we have now to consider how far they can be said to possess Imagination. And this branch of the enquiry is all the more important, inasmuch as man himself is far more largely controlled by his imagination than by his reasoning power. By the term we must understand not so much the *John Willet*-like state of philosophic trance, which that worthy conceived could be so effectively attained by sitting alone upon the Monument for a couple of hours, but rather the re-arrangement, in a sort of mental kaleidoscope, of the conceptions which memory furnishes.* These, when shaken up together, produce new and symmetrical compositions, delightful sometimes from their apparent novelty, but the basic novelty of which consists not in the materials, but in their arrangement, whilst the whole is overlaid with a species of mirage due to the mental atmosphere, and is melancholy, sombre, or cheerful according to the mood and age

* Addison, in his elegant essay on the Imagination, confines the term to ideas derived from the sense of sight. It is evident, however, that *all* the senses contribute their share of the materials with which imagination deals.

of the thinker. If this be a correct view of imagination, it is certain that animals possess the faculty in common with man. It may be seen in the shying horse starting from some familiar object which his fancy magnifies into danger. Seneca and Lucretius remarked that sporting dogs appear to hunt in their dreams; and many of us may have had the opportunity of witnessing our domestic pets bark and snap during their slumbers at imaginary foes. I have heard a canary sing a portion of its song while still apparently asleep. And the phantasmagoria of dreams are clearly, from the definition just given, a form of the operation of the imaginative faculty. It is quite common, also, to find animals in their waking moments recoiling from purely imaginary dangers. Thus, in addition to the case of the shying horse already referred to, you will remember the well-known anecdote of the tiger bounding towards a lady, and being turned into headlong flight by the opportune opening of her parasol. A more recent case, in which another tiger was concerned, is recorded by Dr. Lindsay.* It escaped in the streets of Calcutta from confinement, but fortunately met almost at once with a terrifying spectacle not entirely unknown to ourselves. A steam roller was at work, and the tiger, upon perceiving it, became at once so frightened, that he turned short round, ran back by the way he came, and finding the door of a house open, ran in, sprang over a table at which four people were sitting at breakfast, and eventually took up his quarters quietly in the corner of an adjoining kitchen, from which he had to be decoyed by the bait of a live kid.

I need not, however, enter into further detail upon this branch of our subject. It is abundantly clear that animals possess imagination as well as human beings.

We come next in the progress of our discussion to the

* *Mind in the Lower Animals in Health and Disease.* London, 1879.

Will and the Emotions. With regard to the former, little need be said. Will is undoubtedly present in all animate beings, from the highest to the lowest; and an animate being without a will of its own is to most minds simply inconceivable. The idea of conscious volition is, in fact, a line which we usually draw in thought between the animal and vegetable kingdoms. In respect of Will, it is clear, therefore, that man does not stand alone.

With regard to the Emotions, the evidence is equally conclusive. There is no passion which may not be found represented in the lower creation. Fear, jealousy, affection, melancholy, hatred, pity, are all instanced in many authentic anecdotes of animals which may be recalled. The one domestic animal, the dog, is found, in fact, to manifest all these feelings, each in their turn, as truly as does man himself. Upon this branch of the subject, and as important collateral evidence upon the point, I would refer those who are interested in it to Darwin's book upon *The Expression of the Emotions in Man and the Lower Animals.* He clearly shows that many emotions which in man are evidenced by external signs, such as fear, affection, mirth, combativeness, etc., have also their appropriate and corresponding language of signs in some of the lower animals. Facts like these speak volumes in favour of the position just advanced.

There remains, therefore, only one form of mental activity, if our primary analysis of mind is correct, in respect of which it is possible to contend that man differs essentially from the animals. That is in the possession of Reasoning power. And, as it happens, it is upon this point that the case for essential difference has generally been made to rest, although the term reason is often extremely loosely employed in relation to the subject by those who make this the ground

of their contention. It becomes, therefore, necessary to discuss the nature of the reasoning faculty in man with especial care, in order to arrive at accurate conclusions for the purpose of our comparison.

The reasoning faculty, then, as distinguished from other mental activities, consists in the power of drawing inferences by a process which is in part purely mental. This process is clearly coextensive and coincident with that which is generally comprehended under the term *logic*, logic being not only a science of reasoning, but also a descriptive theory of the method which the human mind adopts for the purpose of reasoning. It happens that this subject of logic is of all branches of mental science the one which has been most thoroughly dealt with, and upon which the most definite conclusions have been reached. Let us consider, therefore, what the great writers upon logic have to tell us as a prelude to the further development of our enquiry.

I need hardly remind you, then, that it was to Aristotle, perhaps the most original thinker who ever lived, that we are indebted for the first formal theory of the logical process. The dialectics of his predecessors bore no such systematic character. But Aristotle propounded the doctrine of the syllogism, and it is hardly too much to say that from the time when his writings became generally known, down to the time of Lord Bacon, an interval of something like seventeen hundred years, the doctrine of the syllogism ruled supreme over the scholastic intellect of every country in Europe. The theory was simple enough. It is practically summarised in the celebrated dictum *de omni et nullo*. That, says Aristotle, which can be predicated of a class, can also be predicated of everything comprehended within that class; and, on the other hand, that which can be denied of a class, can also be denied of every member or individual of which that class is made up. The scholastic logicians have ever

since agreed that all reasoning is based upon these two rules; and we may, therefore, pass over in silence intervening writers on the subject, and come down at once from the fourth century B.C. to our own time, when we again find the same theory advocated by the late Archbishop Whately. In his work on *Logic*, a book which has probably been more widely read than any other treatise ever composed upon the subject, he tells us that in every instance in which we reason in the strict sense of the word, a certain process takes place in the mind, which is one and the same in all cases, provided it be correctly conducted,* and this process is in effect to proceed by means of a syllogism or syllogisms framed in accordance with the above-named general rules.

According to Whately it is therefore certain that there is no one of the audience I address who is not continually in the habit, whether consciously or not, of turning out in his mind, as from a mould, a succession and variety of syllogisms. But, just as in the act of walking there is involved a complicated train of muscular action which pedestrians in general would find it exceedingly difficult to describe, so it may be that the reasoner is also unaware of the mechanical process by which he is supposed to proceed. For the benefit, therefore, of those who have no exact ideas upon the subject of syllogisms, I will briefly explain the meaning of the term.

A correctly-framed syllogism, then, consists of three propositions, two of which are called the premises, and the third the conclusion. In one of these premises something is asserted or denied of a class of objects or things. In the other premiss it is asserted that something else is included in the class already referred to. The conclusion then follows, that what has been stated as true of the class is

* Whately's *Logic*, Book i., § 1.

also true of that which is comprehended within it. Thus, to adopt an illustrative syllogism, we say—

All animals with frontal horns are ruminants;
Antelopes are animals with frontal horns; *
Therefore antelopes are ruminants.

This is the typical form of the syllogism. Logicians, it is true, enumerate different moods and figures, as they are called, but these differ from each other only in the arrangement and the quantification of the terms, and not in the essential character which gives the syllogism its validity. That validity depends chiefly upon one essential condition, which is that one of the two propositions called premises shall contain what may be termed a *universal* statement, for unless this be the case, according to the scholastic logicians, nothing can be inferred. Thus it is meant that in the case already cited, unless we are in a position to assert that *all* animals with frontal horns are ruminants (which is in this instance the universal statement), we could not have proceeded, at least from the premises, to the conclusion that antelopes are ruminants. For if only *some* frontal horned animals were ruminants, it would remain possible that antelopes were not amongst the "some," and thus no inference would follow.

In every valid syllogism, then, which deals with true matter, there must, therefore, be one premiss which is universally true, and a theory which embraces this postulate is represented to us as being a satisfactory account of the nature of the reasoning process. But I think it will be evident to any one whose mind is not already prepossessed by his scholastic studies, that to reduce *all* reasoning to a process of this nature is thoroughly inaccurate. It will surely not be denied, for example, that children reason from

* In some species of antelopes the female does not possess horns; this, however, does not affect the syllogism.

the earliest age. To assert the contrary, would be to propound the paradox that they begin to reason at a certain age, and do not reason before it. Is it to be supposed, then, that in the reasoning process of the young child there can be anything of the nature of a universal premiss? If a child did not begin to reason until it had in its mind what appeared to be a universal truth, it would clearly never begin to reason at all. So again with man in his aboriginal state. If we wish to avoid the difficulty of supposing that in a certain stage of his racial development reason dawned upon him, whilst prior to that all was intellectual night, we must assume that the genus *Homo* possessed the reasoning faculty from the first moment of man's coming into being. But at that first moment he could not possibly possess a universal premiss. His knowledge could only be gathered up as a succession of individual truths. If, therefore, the dictum *de omni et nullo* is the only real basis of the reasoning process, man could not have reasoned till he had classified those truths into general and universal propositions. Classification itself, however, is clearly a process of reasoning. And thus we are confronted with the dilemma—

Either man reasoned before he classified, or he classified before he reasoned;

But, as classification is a form of reason, he could not have done the latter;

And we are, therefore, driven to the conclusion that reason preceded classification and consequently that the *dictum* is not the universal basis of the reasoning process.

These considerations sound, I am afraid, a great deal more abstruse than they really are; and therefore I will endeavour to illustrate the insufficiency of the syllogistic theory in a concrete form, which will possess some familiar features. The Darwinian theory of the *Origin of Species*,

previously referred to, is probably well known to every one present, and I will endeavour to exhibit the argumentative steps by which that theory is attained in a syllogistic form.

Mr. Darwin fairly describes his celebrated book as one long argument. The argument is long, however, chiefly in the sense that the writer had necessarily to occupy much space in illustrating certain fundamental positions by a lengthy and admirable accumulation of facts, and it is possible to summarise his train of reasoning, as such, in the following few propositions:—

(1.) All races of domesticated animals have been subject to great variations due to human selection.

(2.) If human selection can produce such great variations in domestic animals, any other process of continuous selection would produce variation in animals which have not been domesticated.

(3.) There is and has been a process of selection always going on during the whole history of life upon our planet, such process being due to the struggle for existence, and the principle of the survival of the fittest.

(4.) Such a process of selection continued for such a length of time, is sufficient to account for all the specific differences with which we are acquainted.

(5.) Not only will such a process of selection account for these specific differences, but it will also account for many observed facts such as the following:—

(*a.*) That in a region where many species of a genus have been produced, these same species present many varieties.

(*b.*) That species of larger genera differ from each other by a less amount of difference than do the species of smaller genera.

(6.) Viewing the above statements as a whole, it follows that the specific differences with which we are acquainted,

and indeed all specific differences, are due to this process of natural selection.

Reduced to the syllogistic form, and expressed as a *sorites*, or string of syllogisms, each, as far as may be, dependent upon its predecessor, the above line of argument may be stated in substance as follows :—

(1.)

Human selection of domestic animals is a cause of variation.
But human selection is a form of continuous selection ;
Therefore, every form of continuous selection of any kind of animals is a cause of variation.

(2.)

Every form of continuous selection is a cause of variation.
Natural selection is a form of continuous selection ;
Therefore, natural selection is a cause of variation.

(3.)

Natural selection is a cause of variation.
Causes of variation ultimately produce specific differences ;
Therefore natural selection has produced specific differences.

(4.)

Natural selection has produced specific differences.
The differences between adjacent forms of life are specific differences ;
Therefore, the differences between different forms of life have been produced by natural selection.

(5.)

If the variation of species by natural selection is a true hypothesis, the phenomena referred to above (*a* and *b*, etc.) would follow.
But these phenomena are really in accordance with observed facts, and therefore the variation of species by natural selection is a true hypothesis.

Of the above syllogisms, the four first are categorical, and are so connected that, so far at least as they are concerned, *all* of them must be valid in order to prove the ultimate conclusion. The fifth syllogism is conditional and independent of the others, and rests entirely upon its own logical merits. Viewed upon this ground, it must, however, be at once dismissed by the formal logician as a case of the well-known fallacy of inferring the truth of the antecedent from the truth of the consequent. Reverting, then, to the preceding four syllogisms, we find that the first, third, and fourth are invalid according to the rules of formal logic. The conclusion of the first introduces a new term, and, even if this were not so, it shows an illicit process of the minor. The second is regular, and is a syllogism in the mood termed *Barbara*. The third is a case of non-distributed middle, and is therefore a fallacy. The fourth and concluding syllogism of the series to which it belongs is also a case of non-distribution of the middle term, and therefore invalid.

According to rigid logical rule, then, as taught by Whately, Darwin's great argument would tumble to pieces, like a chain broken in three or four places, and could absolutely prove nothing. But an argument which has carried irresistible conviction to so many enlightened minds is evidently far superior to the arraignment of any such tribunal. The formal logicians may tell us that there is nothing in it, but men's minds generally have determined otherwise; and thus it follows that the process of scholastic logic is not that by which men always reason. It may be said, indeed, that I might have framed my illustrative syllogisms otherwise than I have done. Such is no doubt the case. With a little exercise of ingenuity it would be possible to set up some other permutation of the terms. But no ingenuity whatever would avail to construct the argument into the form of irreproachable syllogisms.

If other proof of the insufficiency of the syllogistic theory were required, it might, however, be obtained from Archbishop Whately himself, when discussing the allied subject of Rhetoric. He tells us, in his treatise on that subject, of a certain argument, which he calls the argument of *progressive approach*, and to which he allows a high degree of force. He cites, as an instance of this form of argument, the demonstration of the law of nature called the *vis inertiæ*, viz.; that a body set in motion will eternally continue in motion with uniform velocity in a right line, so far as it is not acted upon by any causes which retard or stop, accelerate, or divert its course. Finding, he tells us, that the original impulse is, in every case we can examine, more and more protracted in proportion as we more and more remove impediments to motion from friction and resistance of the air, we reasonably conclude that if this could be completely done (which is out of our power), the motion would never cease, since what appear to be the only causes of its cessation would be absent.

I admit at once the cogency of such an argument, but the most ingenious logician could not express it in a syllogistic form. And thus Archbishop Whately, in the *practise* of reasoning, refutes his own *theory* of the process.

The theory of the syllogism, therefore, though it has some useful points, cannot possibly be accepted as representing the process which always takes place in the mind in drawing what is, nevertheless, a legitimate conclusion. Not, indeed, that formal logic is therefore useless. It is not only a good mental exercise to study its rules, but they furnish in many cases the means of placing a train of reasoning in such a form as to show where the error, if any, is likely to lie.

It was doubtless for reasons analogous in some degree to those I have stated, that Lord Bacon, in his *Novum Organon*, and elsewhere, inveighed so strongly against the scholastic

logic. But the gravamen of his charges appear to have been that the logicians neglected observation, and occupied themselves with verbal questions. His attacks were therefore rendered against the abuse of the method rather than its use. Could Lord Bacon have been privileged to converse with John Stuart Mill, after the fashion of the imaginary conversations of Landor, as to the merits of the system of logic propounded so long after his time by the philosopher of Westminster, it is certain that he would have found himself much in accord with the views expressed by the latter writer.

Mill's work on Logic will probably be considered in the future as the greatest of his literary achievements. All his books are valuable; he left a great intellectual cairn to mark his memory, but it was in dealing with the subject of logic that his clear intellect found its most appropriate sphere of exertion. He points out the insufficiency of the syllogistic theory of reasoning. Flying deliberately in the face of Aristotle, he tells us that not only may we reason from particulars to particulars without passing through generals (universals as I have termed them), but that we perpetually do so reason. He resolves all inference, consequently all proof and all discovery of truths not self-evident, into induction and the interpretation of inductions, and lays it down that all our knowledge not intuitive comes to us exclusively from that source. What induction is, therefore, and what conditions render it legitimate, cannot but be deemed, according to Mill, the main question of the science of logic.

I believe that in these views Mill is essentially right, and that as nearly as a word can do so, the term "induction" accurately describes the process which takes place in the mind in the act of reasoning. But it appears to me that Mill is in error in his further development of this portion of the subject, and as the error is, from my point of view, material, I am compelled to deal briefly with the general

basis upon which he makes his theory of induction to rest.

For the efficiency to the mind of inductions in general, Mill demands, as a necessary postulate, that there should be some certain and universal inductions still wider in their scope, and it is only in respect of there being such that, according to him, a logic of induction is possible. He goes on further to tell us that these certain and universal inductions are the laws of Number, the law of Space or Mathematics, and the law of Causation. And he thus rests his whole theory of the cogency of inductive reasoning (and therefore all proof) upon a basis which is to my mind totally misleading. If the laws of Number, Space, and Causation, or any of them, are essential to the reasoning process, it clearly follows that no one could have ever reasoned logically without tacitly admitting them. Any demur to these laws would be fatal. But unless these laws are absolute intuitions—which few would be bold enough to contend—it is certain that the reasoning process in the young or uneducated can be attended by no such postulate whatever.

It is possible, however, to show from still another point of view the fallacy of postulating these laws. The laws of Number and Space are purely hypothetical. The whole theory of Number rests upon an assumption—that of Unity. But the idea of Unity is a subjective abstraction. There is no such thing in nature, or in the compass of our experience, as absolute unity; and therefore all arithmetic, which is developed from the idea of absolute unity, is, to our apprehension, exactly true only because in its every step it carries with it the original assumption. But that cannot be an absolutely certain induction which contains in its every step a pure assumption; so that the science of Number has no such claim to infallibility as Mill assigns to it.

Much the same considerations apply to the laws of Space or Mathematics. These rest entirely upon the abstract

notion of equality. But there is no such thing in nature as exact equality. If we do not detect differences between any two objects, we may always be assured that more exact means of observation would show them to exist. And thus, again, the so-called absolute certainty of mathematics falls into a similar category to that of number. There is an assumption in the premiss from which we start; and here again, therefore, the objection applies that that cannot be an absolute and certain induction which really at the same time contains a purely arbitrary hypothesis or convention.*

The only conception of number and space which can be regarded as at all corresponding to the nature of things as we observe them, is, in fact, that of the Calculus, which considers quantities as varying continually, and their value as being obtained only approximately and between limits.

So, again, with Mill's law of Causation, and it is this which, according to him, is the chief pillar upon which induction must be made logically to rest. It is a universal truth, we are told, that every fact which has a beginning has a cause. But however clear this may have appeared to Mill's mind, it is, I think, beyond question that there are thinkers who would refuse to give their adhesion to it. No believer in a First Cause can do so who believes at the same time that the First Cause may have had a beginning. For a First Cause can have, *ex hypothesi*, no antecedent cause. And thus, when Mill rest his theory of induction upon his law of Causation, he is practically asserting that no believer in a First Cause can ever reason logically unless he is also quite clear in his mind upon the point that the First Cause had no beginning. Surely, however, this is a *reductio ad absurdum;* and for these various reasons, whilst I admit

* Above was in type before Professor Cayley's Presidential Address to the British Association appeared; hence no reference is made to his criticisms upon Mill's ideas with regard to Number and Space.

fully the correctness of Mill's views as to the importance of induction, I entirely disclaim the foundation and sanction by which he justifies the validity of the process. And before passing further, let me just point out that the conclusions which are arrived at in the Darwinian theory of the Origin of Species, used above by way of illustration, are as absolutely incapable of proof by Mill's method as they are by Whately's. The complete process of proof, according to Mill, requires, first, induction, and then verification. So that to prove the variability of species we should require absolute evidence of some species having become transmuted and developed from some other species. But evidence of this nature is exactly what we have hitherto been unable to obtain. Darwin's hypothesis is, so far, verifiable only as regards the extinction of some forms of life, but not at all in respect of the genesis of new ones specifically different from their progenitors. And, therefore, according to Mill, as well as Whately, the Darwinian theory would fall to the ground.

There remains only one other writer whose views on the subject of Logic I think it needful now to refer to. Professor Jevons, who was cut off in the prime of his manhood by an untimely accident, and whose originality as a thinker was evidenced in more than one branch of intellectual activity, produced a volume* which establishes a distinct advance upon anything that had previously appeared. His cardinal principle is that the "substitution of similars" is the basis of all reasoning; that is to say, that we pass from one proposition to another by substituting a new but similar term in the new proposition in the place of the equivalent or homologous one in the original. In this view, I believe that Professor Jevons embodies a profound truth. Had he

* *Principles of Science: a Treatise on Logic and Scientific Method.* 3rd edition. Macmillan, 1879.

adhered to it in its simplicity, I would have adopted his theory without criticism. But he departs from it in the expansion of his system. He assigns to the deductive process an importance which it cannot from my point of view be conceded to possess. He substitutes throughout his formal equations the idea of identity for that of similarity, thus throwing away in practice the very key to the true nature of the logical faculty. Reverting to the argument of Darwin, we again find that this chain of reasoning cannot be developed on the basis of Jevons' identic propositions, any more than by accepting the views of Whately, or of Mill.

I arrive, in fact, at this conclusion, after surveying the opinions of the three representative writers at whose views we have glanced, that we must take something only from each of their systems in order to construct a true theory of the reasoning process as it actually takes place. All of them appear to me to have overlooked a very important circumstance. No theory of the reasoning process can be a correct description of it which does not account for all the various forms of its exercise. It is evident that the fundamental elements of the method of reasoning must be the same in ignorant persons as in the best cultivated. The process may not be so accurately conducted, but there can be no material difference in kind between reason in the philosopher and reason in the savage. Even persons who do not in the least comprehend the rules of the syllogism as laid down by Whately and others, the necessity of the law of Causation as postulated by Mill, and the permutations resulting from the identical propositions of Jevons, do nevertheless reason. So that what is required is a law of thought which shall account for the crude inductions of the child, and which shall yet lie at the base of the most profound trains of reasoning of a Newton. Both reason; and no description of the funda-

mental features of the logical process which will not apply equally to both can be a correct one.

In the first place, then, we must agree with Mill, that all real knowledge is gained by induction, and induction only—by observation, that is to say, of that which comes under our apprehension. Secondly, we must admit, with more fullness and fidelity than Jevons, that we can only reason from one thing, or fact, to another in respect of the similarity which exists between them. And with Whately, and the ancient school which he represented so well, we may with advantage draw all arguments into a form approximating to that of the syllogism for the convenience of criticism.

We come to the conclusion, then, that all reasoning is simply founded upon a perception of similarity or difference in the data; and its canon may be laid down nearly in the words of Jevons himself, though we must apply it with more universality than he did:—

That which is true of a thing is probably true of its like; the degree of probability depending upon the extent and thoroughness of the resemblance.

All conclusions at which we arrive by reasoning are obtained by means of this fundamental conception, and are therefore probable truths only; the so-called process of reasoning, being simply, therefore, an estimation of probabilities based upon past knowledge and present data.

This principle is clearly as applicable to the child or savage as to the man of science, the latter simply reasoning better because he knows more. But the process is the same always. A child tastes a lump of sugar; it pleases the infantile palate, and the little hand is stretched out for another white crystalline lump, on the simple induction that because one such lump was palatable, another which resembles it is

likely to be palatable also. He does not frame a syllogism, the major premiss of which is that *all* white crystalline bodies are agreeable to the taste; nor yet does he reason with Jevons, that the two lumps of sugar are identical. So again with the scientific expert. In his long survey of animal forms he has found that all the animals with frontal horns of which he has any knowledge ruminate; and he argues that in all probability all others possessing the same peculiarity ruminate. Applying the process to the Darwinian theory, we get the following propositions:—

It is a known fact that it is possible to vary the form and qualities of domestic animals by selection.

That which is true of all domestic animals is probably true of all animals.

It is therefore probable that the form and qualities of all animals may be varied by selection.

That which is true of one mode of selection is probably true also of natural selection.

It is therefore probable that the form and qualities of all animals may be varied by natural selection.

If a certain degree of variation can be established in a given time, it is probable that the longer the time the greater the variation; and thus, if time enough be allowed, any degree of variation would be accounted for.

Natural selection would thus probably account for the variation or differences observed between nearly all living forms. And as it would also account for a vast number of observed and collateral facts, the origin of species by means of natural selection is probably a true hypothesis.*

It follows, then, from these considerations, that all reason

* It is evident that it is in the last sentence that the weight of Darwin's argument mainly lies. Hypotheses are probable in proportion as they serve to account for observed facts. The correspondence between this circumstance and the inverse law of probability is obviously exact.

is in my view of it simply a more or less accurate estimation of probabilities, and that it obeys, when analysed, exactly the same law. There is no such thing as absolute certainty obtainable, the subjective state which we call certainty being produced only by an illusion of the imagination. And thus the fundamental principle of the reasoning power is shown to consist merely in the perception of similarity or difference between things compared with each other, inferences following from such comparison in terms of the canon already laid down.

Returning, then, with this conclusion in hand, to the main line of our enquiry, we have now only to ask whethe the lower animals do not, as well as man, give proof that they conduct in their intelligence a process of the nature indicated, a process, that is to say, in virtue of which they compare together certain facts or observations and are led to draw inferences from the similarities or differences which come to view between them.

There can, I believe, be but one reply to such a question. The main difficulty, in fact, in proving an affirmative answer to it is really to choose convenient illustrations amongst the very great number that might be cited. It is clear, however, at the outset, that all the operations which are generally regarded as purely instinctive, such as the choice of certain articles of food and the rejection of others, the facts of nidification, cell-making, etc., might be assigned to this category. But in deference to the opinions of those who are wedded to a distinction between reason and instinct, I will take just one or two illustrations which are as far removed as any animal actions well can be from the ordinary conception of instinct.

A notice recently appeared in the local newspapers of a certain dog which belonged to the Chester fire brigade.

Whenever a signal of fire was given, this dog rushed into the street, and barked till every fireman arrived. Twice he was brought out from burning houses nearly suffocated, and twice he was ridden over by the fire-engine; but, in spite of these misadventures, he continued to practise his self-assumed profession with the utmost assiduity. The case of this dog is not by any means a singular one in its main features. A London fireman, of the name of Samuel Wood, who was himself said to have saved the lives of nearly a hundred men, women, and children, was greatly aided in his meritorious efforts by a dog named "Bill." This dog would run about barking on the alarm of fire, as if calling people to come and help. He would mount a ladder with as much agility as his master, and he once saved his master's life by finding a way by which he was enabled to crawl out of a burning apartment. "Bob," another fireman's dog, similarly accomplished, discovered at a fire in Lambeth a child in a house from which it was supposed that all the inmates had been rescued.

Now, it is quite clear that this recorded conduct of the three dogs was as far as possible from what, coming to consider the matter without prepossession, we should ordinarily regard as instinctive. Neither food, safety, nor comfort was in prospect as these animals took up the alarm. They heard, far off, the dreaded cry coming through the deserted streets; they knew the meaning of the rising smoke and the bursting flame, and drew, as men might have drawn it, the inference that a state of things had arisen which called for the prompt intervention of their human friends, whose achievements they had witnessed and admired before. And it is hardly possible to doubt that as the fire-escape and the engine rattled up through the gathering crowd, the dogs, as well as the men, were seized with an enthusiasm of daring and rescue which was stronger than

the terrors they confronted, and which led them from past experience to search for human beings who would otherwise have been sacrificed to the devouring elements. So that here we have a complete case of reasoning by similarity; the dogs reasoned exactly as their masters did on the same subject.

It would take up far too much of your time if I were to give many further illustrations, and I shall therefore only cite one other, and that chiefly because it shows the animal as reasoning from similarities which also involve the perception of differences. Some insular districts of Scotland are separated from each other by comparatively narrow channels through which a current runs with great rapidity at certain times of the tide. A case is recorded of a dog which was in the habit of accompanying its master from one island to another, with this difference, that the master went in a boat, whilst the dog swam. The tidal current, of course, flowed sometimes in one direction, sometimes in the opposite. The dog, however, always judged most accurately of the part of the shore at which it should enter the water in order to allow for the effect of the tide. Sometimes it had to go some hundreds of yards one way, sometimes as much in the other direction; but he always managed to make the landing-place most accurately. Now, in this case, the dog must have possessed a very keen perception of difference of conditions as well as of the general fact of there being a current, and he drew his inferences with regard to both most successfully.*

From these representative instances then, and the myriads of analogous ones which might be cited, it appears to me quite certain, having regard to the results of our investigation into the nature of the reasoning process in man, that

* A similar calculation is made by geese when swimming across the Danube.—BÜCHNER, *op. cit.*

the lower animals do also possess and practise in their measure exactly the same method of inference as ourselves. Like us, they draw inferences from similarities and differences; like us, they infer from past events and past knowledge the probabilities of the future and of circumjacent events and facts in general.

The conclusion thus arrived at brings us clearly to the end of our enquiry. We have seen in its earlier stages that all the other qualities of mind are possessed by animals, and therefore it now follows that, as a matter of extremely high probability, there is no essential difference whatever in the intellectual constitution of man and that of those other races of living beings who are his contemporaries and companions in the world around him. The processes which go to constitute man's mental activities are found as truly in their measure in the brute, and man is therefore in no intellectual respect made of other clay than the rest of the associated fauna of our planet.

Such a conclusion as that which we have arrived at, however distasteful it may be to some, is not, as is sometimes represented, in any respect degrading to humanity. It leaves the position of man unassailed. The only result is to raise the lower creation nearer to us in dignity, and to render it more than ever before deserving of our close and earnest study. Even as comparative anatomy and comparative physiology have thrown light upon man's physical being, so also will comparative psychology teach us in the future far more than those rudimentary facts which at present do duty with the philosopher for a science of mind.

And the conclusion we have reached helps us further to a probable generalisation which, to me at least, is of a pleasing and satisfactory character. Though man is removed by it from a position of racial isolation; though he is no longer to

be regarded as the Ptolemaic centre of life, round which inferior beings circle, we reach through it the idea that life and mind are everywhere coexistent and coextensive. In all the forms of earth life, in all the forms of life which analogy leads us to believe people the starry host which is as the sands of the sea shore for multitude, conscious mind and intelligence light up an intellectual firmament as spacious and as boundless as that which the astronomer seeks in vain to fathom with the most far-reaching and perfect instruments at his command. The vast universe in which we live and move is a universe of thought, of which our human feelings are but a small and limited expression. Confined by no ties of space, reaching into the past and into the future, the universe throbs with the consciousness of the sentient creatures with which it swarms, bound to each other in an infinite harmony which knows no end, which is derived from a common origin and which indicates perchance a common destiny.

A PILGRIMAGE TO OLNEY AND WESTON UNDERWOOD.

By Sir JAMES A. PICTON, F.S.A.

Perhaps the most genial and pleasant form of hero-worship is the interest taken in the localities hallowed by the presence and associations of the illustrious departed. As our grand old lexicographer says :—"To abstract the mind from all local emotion would be impossible if it were endeavoured, and would be foolish if it were possible." The surface of our country is redolent with the memories of gallant deeds in battle for the right, martyrdom for the truth, patient endurance and active effort in the cause of righteousness and humanity. Nor the less do we honour the associations with those who in a less conspicuous walk have contributed by their writings to the solace, elevation, and progress of the human mind.

Few writers have excited more sympathy in their readers than William Cowper. The texture of his intellect, hovering between genius and insanity; his melancholy history, with its tragic termination; the vigour, beauty, and high tone of his poetry, and his charming correspondence, with its playful raillery and little weaknesses, have endeared his memory to thousands of readers during the last three generations.

I had long desired a pilgrimage to the haunts of the poet, and the scenes hallowed by his memory, and a few months ago circumstances gave me the opportunity.

I approached the locality by way of Northampton, which is a good specimen of an old English midland town, somewhat modernized by its manufacturing proclivities, but still

preserving a few picturesque old mansions, and several ancient churches worthy of note. The church connected with the memory of Cowper is All Saints, situated in the centre of the town, and only remarkable for its almost unparalleled ugliness. It is of the Georgian era, in what might be called the "high falutin" style. In front there is a vast portico of columns, forming a kind of Narthex or Parvise, over the centre of which stands a statue of Queen Caroline—not her of Brunswick, but the Caroline celebrated in the *Heart of Mid Lothian.* The body of the church is a mass of unsightly absurdity.

The poet, in a playful letter to Lady Hesketh, dated Weston, November 27th, 1787, thus relates his introduction to All Saints:—"On Monday morning last, Sam brought me word that there was a man in the kitchen who desired to speak with me. I ordered him in. A plain, decent, elderly figure made its appearance, and being desired to sit, spoke as follows:—'Sir, I am clerk of the parish of All Saints, in Northampton. It is customary for the person in my office to annex to a bill of mortality which he publishes at Christmas a copy of verses. You will do me a great favour, Sir, if you would furnish me with one.' To this I replied, 'You have several men of genius in your town, why have you not applied to some of them? There is a namesake of yours in particular, Cox, the statuary, who, everybody knows, is a first-rate maker of verses. He surely is the man of all the world for your purpose.' 'Alas! Sir, I have heretofore borrowed help from him, but he is a gentleman of so much reading that the people of our town cannot understand him.' I confess to you, my dear, I felt all the force of the compliment implied in this speech, and was almost ready to answer, 'Perhaps, my good friend, they may find me unintelligible too, for the same reason.' But on asking him whether he had walked over to Weston (eleven miles) on

purpose to implore the assistance of my muse, and on his replying in the affirmative, I felt my mortified vanity a little consoled, and, pitying the poor man's distress, which appeared to be considerable, promised to supply him. The waggon has accordingly gone this day to Northampton loaded in part with my effusions in the mortuary style. A fig for poets who write epitaphs upon individuals! I have written one that serves *two hundred* persons."

The stanzas thus contributed are those commencing:—

> "While thirteen moons saw smoothly run
> The men's barge-laden wave,
> All these, life's rambling journey done,
> Have found their home, the grave.
>
> * * * * * *
>
> Like crowded forest trees we stand,
> And some are marked to fall;
> The axe will smite at God's command,
> And soon shall smite us all," etc.

In the three following years, 1788–90, Cowper assisted his humble friend by the composition of the annual mortuary verses, but during the two years, 1791–2, there is a cessation, which is thus explained by the poet himself in a letter to Hayley, dated November 25th, 1792—

"I was for some years dirge-writer to the town of Northampton, being employed by the clerk of the principal parish there to furnish him with an annual copy of verses proper to be printed at the foot of his bill of mortality; but the clerk died, and hearing nothing for two years from his successor, I well hoped that I was out of office. The other morning, however, Sam announced the new clerk; he came to solicit the same service as I had rendered his predecessor, and I reluctantly complied; doubtful, indeed, whether I was capable. I have, however, achieved that labour, and I have done nothing more."

The last of these contributions was in 1793, and is perhaps the finest of the series:—

"He lives who lives to God alone,
And all are dead beside;
For other source than God is none
Whence life can be supplied.
To live to God is to requite
His love as best we may;
To make his precepts our delight,
His promises our stay," etc.

Not very long afterwards he experienced a return of the mental affliction, from which he never recovered.

The town of Northampton is almost wholly given up to shoemaking, many establishments on a large scale providing "soles" and "uppers" for the modern Britons, which imparts to the general aspect of the place a lively and busy appearance.

The distance between Northampton and Olney (about eleven miles) is rich and well cultivated, the large size of the enclosures, at this time bristling with grain crops, giving evidence of farming on a large scale.

The small town, or village of Olney, consists principally of one long street running north and south, and expanding at the south end into a spacious triangular area, called the market place, though the market has long ceased to exist. The base line of this triangle looking down the street is occupied by a row of houses, a road branching off at each end. Cowper's house is nearly in the middle of this row. It is the largest and loftiest house in the village, three stories in height, with eight windows on each floor. The material is red brick with stone dressings. In the centre is a covered passage running through to the back. The entrance door is nearly in the middle of the front. The celebrated parlour is very visible.

"Now stir the fire and close the shutters fast;
Let fall the curtains, wheel the sofa round,
And while the bubbling and loud hissing urn
Throws up a steamy column, and the cups
Which cheer, but not inebriate, wait on each,
So let us welcome peaceful evening in."

On going through the passage we find the house is not so large as it looks. The back portion is an agglomeration of small parts, very roughly built in stone.

The garden is a disappointment. We read:—

". . . if the garden, with its many cares
All well repaid, demand him, he attends
The welcome call, conscious how much the hand
Of lubbard labour needs his watchful eye.
Hence summer has her riches, autumn hence,
And hence e'en winter fills his withered hand
With blushing fruit and plenty not his own."

The garden is now a tangled mass, divided and subdivided, and a prey to disorder and neglect.

In the centre of the market place stands a noble solitary elm, one of the largest in the kingdom, with splendid outspreading branches, covering a large area. Many generations must have come and gone since as a sapling it first here took root.

"The seasons bring the flower again;
They bring the firstling to the flock,
And in the dusk of thee, the clock
Beats out the little lives of men."

I took up my quarters at a little hostelry called the "Bull," on one side of the market place, in full view of the poet's residence, one of the quaint old-fashioned inns which are fast being swept away by modern improvements. I seemed to be pretty nearly the only guest, and the placid air

of drowsy quiet which predominated, both within and without, was very soothing to the nervous system. In the evening a glorious full moon spread a flood of pearly silver light over the whole surroundings, and converted the homely brick architecture into a fairy scene.

Sunday morning arose bright and cloudless, giving promise of a warm and cheerful day. I first wended my way to the church, which is situated a little outside the town on the south side, very rural and pleasant, with a large graveyard attached. This is remarkable for the floral decorations of the tombs. Splendid rose-trees in full bearing are numerous, and flowers of all hues abound. While I was waiting about, two young women came with baskets of flowers, to decorate a grave—not a new one—overgrown with grass. I thought of Gray's Elegy:—

> "On some fond breast the parting soul relies,
> Some pious drops the closing eye requires;
> E'en from the tomb the voice of nature cries,
> E'en in our ashes live their wonted fires."

The church is a good specimen of early fourteenth century architecture, and with the exception of the chancel ceiling, which has been recently tastefully restored, it has not been interfered with. The flowing window tracery is very good. The stone is oolite, of good colour and texture, and stands the weather remarkably well. The interior has nave and aisles, with a clerestory, and a chancel. The nave is pewed, with a gallery in the north aisle. This and the pews are inscribed with the date of 1765.

The service was very judiciously conducted, in plain fashion, neither high nor low. Whilst it was proceeding I was carried back in imagination a hundred years. It was 1783 instead of 1883. There was Cowper's square pew opposite the pulpit, and there he sat in his shrinking

timidity, with the lustre of genius in his dreaming eyes, listening to the Calvinistic enunciations of his adviser and friend, the quondam slave captain (John Newton). Nothing has changed except the fashion of dress. The neat, pretty, rustic maidens of to-day are the counterparts of their great grandmothers a century ago.

> " So generations in their course decay,
> So flourish these, when those have passed away."

The church, I think, is only once alluded to by Cowper—

> ". . . square tower,
> Tall spire, from which the sound of cheerful bells
> Just undulates upon the listening ear."

Hard by stands the bridge, a long structure, spanning with several arches two branches of the Ouse.

> "Hark! 'tis the twanging horn! o'er yonder bridge,
> That with its wearisome but needful length
> Bestrides the wintry flood, in which the morn
> Sees her unwrinkled face reflected bright,
> He comes, the herald of a noisy world,
> With spattered boots, strapp'd waist and frozen locks,
> News from all nations lumbering at his back," etc

I set out to walk to Weston Park and Weston Underwood, to which Cowper removed from Olney, and near which lie the scenes of his most pleasing associations.

The road is very pleasant, running along the side of a gentle eminence, overlooking the wide valley through which the Ouse winds its placid course. The day was bright and sunny, with just sufficient breeze to temper the heat. At about a mile and a half distance a brook crosses the road where the woods of Weston Park commence. There were the usual ominous warnings against trespassers, but, heedless of steel traps and spring guns (which I suspect never existed

except in imagination), I pursued the noiseless tenor of my way. Climbing the fence, I found a narrow pathway leading upwards through the wood, so tangled with undergrowth as in many places to be barely passable; and in a half or three-quarters of a mile's distance I emerged into the open, and made across the fields for the "Peasant's Nest."

I was here somewhat disappointed. Instead of the lowly cot, I found a substantial farm-house, with extensive out-buildings, such as scarcely bears out the poet's beautiful description :—

> "Once went I forth, and found, till then unknown,
> A cottage, whither oft we since repair;
> 'Tis perched upon the green hill top, but close
> Environed with a ring of branching elms,
> That overhang the thatch ; itself unseen
> Peeps at the vale below ; so thick beset
> With foliage of such dark redundant growth,
> I called the low-roof'd lodge the "Peasant's Nest."
> And hidden as it is, and far remote,
> Oft have I wished the peaceful covert mine."

The situation exactly corresponds with the poetry, but the house has evidently been rebuilt. From this elevation the poet looks out :—

> "How oft upon yon eminence our pace
> Has slackened to a pause, and we have borne
> The ruffling wind, scarce conscious that it blew,
> While admiration feeding at the eye,
> And still unsated, dwelt upon the scene.
> Here Ouse, slow winding through a level plain
> Of spacious meads with cattle sprinkled o'er,
> Conducts the eye along its sinuous course
> Delighted. There, fast rooted in their bank
> Stand, never overlooked, our favourite elms,
> While far beyond, and overthwart the stream
> That as with molten glass inlays the vale,
> The sloping land recedes into the clouds.

Again crossing some fields, I re-entered the park on its north-east side, and passed in succession many of the spots made memorable in the "Task." The gates in many cases were locked, but I managed to climb the fences and to leap the ditches.

The next point in our survey is "The Colonnade":—

"Not distant far, a length of colonnade
Invites us; monument of ancient taste,
Now scorned, but worthy of a better fate.
Our fathers knew the value of a screen
From sultry suns; and in their shaded walks
And long protracted bowers, enjoyed at noon
The gloom and coolness of declining day.
Thanks to Benevolus,* he spares me yet
These chestnuts ranged in corresponding lines;
And though himself so polished, still reprieves
The obsolete prolixity of shade."

This "colonnade" consists of a noble avenue of horse chestnuts, the foliage of which at the time of my visit was riddled with insects.

A small stream enters the park on the north side, and winds round to the east. This is insignificant in itself, but in the course of ages it has formed a depression or valley, which is thus described:—

"Descending now (but cautious lest too fast)
A sudden steep: upon a rustic bridge
We pass a gulf in which the willows dip
Their pendant boughs, stooping as if to drink.
Hence, ankle-deep in moss and flowery thyme,
We mount again, and feel at every step
Our foot half sunk in hillocks green and soft,
Raised by the mole, the miner of the soil," etc.

We next come in sight of the celebrated *alcove*. There

* Sir John Throckmorton, of Weston Hall.

are two alcoves not very far from each other, on the slope where the park fence turns southward along the west boundary. The upper one is in the best repair, and is a substantial stone structure, hexagonal in plan, three of the planes forming the open alcove, the angles supported by stone columns. The other, lower down the slope, is a flimsy wooden affair, in a very ruinous condition. It is probably the upper one to which Cowper refers :—

> "The summit gained, behold the proud alcove
> That crowns it ! yet not all its pride secures
> The grand retreat from injuries impress'd
> By rural carvers, who with knives deface
> The panels, leaving an obscure rude name,
> In characters uncouth, and spelt amiss.
> . . . Now roams the eye ;
> And posted on this speculative height,
> Exults in its command."

Proceeding further, he continues :—

> "Not less attractive is the woodland scene,
> Diversified with trees of every growth,
> Alike yet various. Here the gray smooth trunks
> Of ash, or lime or beech, distinctly shine
> Within the twilight of their distant shades."

Here follows a descriptive catalogue of the various trees, then :—

> "O'er these, but far beyond (a spacious map
> Of hill and valley interposed between),
> The Ouse, dividing the well-water'd land,
> Now glitters in the sun and now retires
> As bashful yet impatient to be seen."

We come now to a little dry valley which crosses the path, thus described :—

"Here the declivity is sharp and short,
And such the reascent; between them weeps
A little Naiad her impoverish'd urn
All summer long, which winter fills again."

We now arrive at a square plot in the south-west corner of the park, which is fenced off, with locked gates. This seems to have been originally a plantation of trees, afterwards partially cut down and converted into a "wilderness," with winding walks bordered with shrubs; here and there a classical pedestal and bust, with inscriptions. This enclosure is now utterly neglected and tangled, the pedestals covered with moss and lichen, but it is still carefully protected from intrusion. I ventured, however, to climb the fence and explore the interior. Let us follow the poet:—

"The folded gates would bar my progress now,
But that the lord of this enclosed demesne,
Communicative of the good he owns,
Admits me to a share; the guiltless eye
Commits no wrong, nor wastes what it enjoys.
Refreshing change! where now the blazing sun?
By short transition we have lost his glare,
And stepp'd at once into a cooler clime.
Ye fallen avenues! once more I mourn
Your fate unmerited, once more rejoice
That yet a remnant of your race survives.
* * * * *
And now with nerves new braced, and spirits cheered,
We tread the wilderness, whole well-roll'd walks,
With curvature of slow and easy sweep—
Deception innocent—give ample space
To narrow bounds."

Passing through the wilderness, I again leaped the fence, and emerged into the park at its lower or southern extremity, where there occurs another avenue or colonnade—

". . . the grove receives us next;
Between the upright shafts of whose tall elms
We may discern the thresher at his task," etc.

The explanation of this is, that on the opposite side of the road at which we have now arrived stand the farm buildings of Weston Hall, the former seat of the Throckmortons. The hall has been taken down since Cowper's time. Besides the outbuildings, only a few fragments of walls and gates remain.

The village of Weston Underwood stands at a little distance along the road westward. It is smaller and more rural than Olney, many of the roofs being thatched.

Cowper removed here from Olney in November, 1786. In a letter, dated November 17th, he says, "I lived longer at Olney than anywhere. There, indeed, I lived till mouldering walls and a tottering house warned me to depart. I have accordingly taken the hint, and two days since took up my abode at Weston."

In a letter of the same date, addressed to Newton, he says, "When God speaks to a chaos, it becomes a scene of order and harmony in a moment; but when his creatures have thrown one house into confusion by leaving it, and another by tumbling themselves and their goods into it, not less than many days' labour and contrivance is necessary to give them their proper places. . . . We find ourselves here in a comfortable dwelling, such it is in itself, and my cousin (Lady Hesketh), who has spared no expense in dressing it up for us, has made it a genteel one. . . . On Wednesday evening Mrs. Unwin and I took possession. I could not help giving a last look at my old prison and its precincts, and, though I cannot easily account for it, having been miserable there so many years, felt something like a heart-ache when I took a last leave of a scene that certainly in itself had nothing to engage affection. . . . I was weary of every object, had long wished for a change, yet could not take leave without a pang at parting."

Cowper's house, called "The Lodge," is the best in the

village. It is a detached building of stone, having a range of seven windows on each floor, with a tolerably spacious garden attached. Here Cowper and Mrs. Unwin remained until their removal to Norfolk, in July, 1795. He was intensely attached to the quiet scenery of the neighbourhood. Under the influence of Lady Hesketh, the gentle recluses were induced to mix a little in society. They visited with some of the gentry of the district. Cowper says:—"We visit at Mr. (afterwards Sir John) Throckmorton's, and at Gayhurst; rarely, however, at Gayhurst, on account of the greater distance; more frequently, though not very frequently, at Weston. The rest of our journeys are to Bozeat turnpike and back again." This mild dissipation rather alarmed Cowper's spiritual adviser, John Newton, who wrote a letter of remonstrance to Mrs. Unwin, "which," Cowper says, "gave us both a good deal of concern, and she is still deeply affected by it." He continues, speaking of the gossips:—"They often see us getting into Lady Hesketh's carriage, and rather uncharitably suppose that it always carries us into a scene of dissipation, which in fact it never does."

When the recurrence of his mental malady, in 1795, rendered a removal necessary, on the eve of his departure he penned the touching lines "To Mary":—

"The twentieth year is well nigh past," etc.

And on the morning of his journey he wrote on the back of the shutter in his bedroom:—

"Farewell, dear scenes, for ever closed to me!
Oh! for what sorrows must I now exchange you!"

The house of Thomas Scott, the commentator, who was Rector of Weston, stands in a garden nearly opposite Cowper's. A little further along the road stands the church, a late Gothic building, with a square tower and

some interesting details. There is no longer a resident incumbent, the living being combined with that of Ravenstone, the adjoining parish, and service held only once on Sundays. Many of the inhabitants are Roman Catholics, the Throckmorton family being of that church. A Catholic church forms part of the remaining hall buildings.

I had a pleasant walk back to Olney. The wide valley, with the placid Ouse meandering on the right, brought to mind "The dog and the water-lily":—

> "It was the time when Ouse displayed
> His lilies newly blown,
> Their beauties I intent surveyed
> And one I wished my own," etc.

The whole neighbourhood is redolent with memories of Cowper. About two miles up the stream, within sight, near Ravenstone Mill, lies the scene of the "Poplar Field":—

> "The poplars are fell'd, farewell to the shade,
> And the whispering wind of the cool colonnade;
> The winds play no longer and sing in the leaves,
> Nor Ouse in his bosom the image receives."

The umbrageous avenues of Weston Park are referred to in the touching lines:—

> "Oh! happy shades, to me unblest!
> Friendly to peace, but not to me!
> How ill the scene that offers rest
> And heart that cannot rest, agree!"

Kilwick Copse, about a mile north of Weston Park, is the scene of the "Needless Alarm":—

> "There is a field through which I often pass,
> Thick overspread with moss and silky grass;
> Adjoining close to Kilwick's echoing wood
> Where oft the bitch-fox hides her hapless brood."

A little beyond this stand the remains of the Yardley Oak, the subject of one of the poet's noblest compositions:

"Time made thee what thou wast—king of the woods,
And Time hath made thee what thou art—a cave
For owls to roost in.
Once thy spreading boughs
O'erhung the champaign, and the numerous flocks
That grazed it stood beneath that ample cope
Uncrowded, yet safe sheltered from the storm.
No flock frequents thee now. Thou hast outlived
Thy popularity, and art become
(Unless verse rescue thee awhile) a thing
Forgotten as the foliage of thy youth," etc.

Clifton Reynes, a short distance to the east of Olney, is celebrated in a merrier mood:—

"I sing of a journey to Clifton
We would have performed if we could,
Without cart or barrow to lift on
Poor Mary and me through the mud.
Sle, sla, slud,
Stuck in the mud,
Oh, it is pretty to wade through the flood!

"So away we went slipping and sliding,
Hop, hop—à la mode de deux frogs;
'Tis near as good walking as riding
When ladies are dress'd in their clogs.
Wheels, no doubt,
Go briskly about,
But they clatter and chatter and make such a rout," etc.

From the localities our minds are instinctively turned to the man whose association gives the charm to the neighbourhood. Will the works of the timid, shrinking hypocondriac stand the test of time and hold their place in English literature? They have already been subjected to the criticism of a century, with all its changes of taste and

fashion, and have not suffered by the ordeal. Cowper is essentially the poet of the middle classes. He is true to nature, but it is nature within a restricted range. He illustrates common sense and common feelings. Like his own favourite river, he is usually placid and gentle, but when disturbed by a sense of injustice or wrong, he can pour forth a torrent of indignation with overwhelming force. He is always perfectly intelligible. The descriptions he presents and the emotions to which he gives utterance are generally of a very obvious character. These qualities of themselves would not constitute a poet, but when the spark of genius lights upon them they are kindled into brightness and warmth. He has the art of calling up, in a few simple words, wonderful pictures, whether descriptive or emotional. Take as an instance the "Loss of the Royal George":—

"Toll for the brave,
The brave who are no more,
All sunk beneath the wave
Fast by their native shore.

"Eight hundred of the brave
Whose courage well was tried
Had made the vessel heel,
And laid her on her side.

"A land breeze shook the shrouds,
And she was overset;
Down went the Royal George,
With all her crew complete.

"Toll for the brave!
Brave Kempenfelt is gone;
His last seafight is fought,
His work of glory done.

"It was not in the battle,
No tempest gave the shock;
She sprang no fatal leak,
She ran upon no rock.

"His sword was in its sheath,
His fingers held the pen,
When Kempenfelt went down
With twice four hundred men.

"Weigh the vessel up
Once dreaded by our foes,
And mingle with our cup
The tear that England owes.

"Her timbers yet are sound,
And she may float again,
Full charged with England's thunder,
And plough the distant main.

"But Kempenfelt is gone,
His victories are o'er,
But he and his eight hundred
Shall plough the waves no more."

The language is simple, even to baldness; the ideas are natural and obvious; yet no one can read the ode without the impression of a grand and solemn feeling.

What, then, is the subtle element which has given vitality to the poetry of Cowper, and preserved it from the abyss of failure and the limbo of mediocrity? The eighteenth century gave birth to many votaries of the Muse, but how many are remembered at the present day? Dryden belonged to the previous century. The genius of Pope has given him a high place in the roll of fame, but his style is too artificial and his tone of thought too conventional for the taste of the present age. Of the worthies commemorated by Johnson in his *Lives of the Poets*, of how many can it be said, not that their works are studied and admired, but that even their names are remembered? Who knows anything of Stepney and Walsh, Duke and King, Sprat and Hughes, Blackmore and Fenton, Yalden and Hammond, with many others now forgotten? Yet these are deemed by

the great lexicographer worthy of a niche in the temple of fame. Parnell and Gay, Somerville and Collins, Dyer and Akenside, Shenstone and Mallet survive as names, but it may be said of their memories, *Stant nominis umbræ.* A few yet maintain their hold on the public notice. The stately march of Gray still captivates. The "Seasons" of Thomson, in spite of a certain amount of turgidity and bombast, have not ceased to charm by their vivid descriptions of nature. Falconer, in his "Shipwreck," has touched with a powerful hand the chords of human nature and life. Blair's "Grave," notwithstanding its subject, contains a rich vein of true feeling; and Young, in spite of his swelling and somewhat obscure style, has attained a high level of poetical expression. None of these, however, can be considered as popular poets. They none of them freed themselves from the trammels of the conventional ideas and style of their age. It was reserved for two men, at the latter end of the eighteenth century—one a humble Scottish peasant, and the other an obscure English hypochondriac, to initiate a revolution in the poetic thought and feeling of the nation. Throwing off the trammels within which poetical expression had been confined, adopting ideas and thoughts common to all, appealing to nature in her outward aspects and inward workings, extending their sympathies to every flower that blows and every emotion which agitates the human mind, they drew out by a subtle charm the music of the chords which vibrate in every heart. Far different as were their characters and themes, there was much common to both. Each had the true poetic afflatus, without which all attempt at song is vain. Each had the same scorn for everything unjust, mean or vile. Each was gifted with a vivid sense of humour. Compare, for instance, John Gilpin's ride with Tam o' Shanter's scamper. Each possessed true religious feelings

and aspirations, obscured though they were in Burns, yet tenderly and beautifully shown in the "Cotter's Saturday Night." A strong patriotic feeling inspired them both; witness the "Scots wha hae" of the one, and the "England, with all thy faults I love thee still," of the other. Both have the same free, transparent style, expressing popular ideas in popular language; and both have their reward in the loving admiration with which their works are still regarded by the masses. The popularity of neither is yet on the wane; and in spite of the erotic effusions on the one hand, and the enigmatic obscurity on the other, it is likely to be still maintained. No doubt, poets of a higher order are now in the zenith, but there is still room for the modest, retiring poet, who so tenderly and powerfully gave expression to the common feelings of the common race. In one characteristic, Cowper resembles Tennyson. Nothing could be more diverse than the styles of the two poets, but each of them has a style which belongs to nobody else, and which by its peculiar ring intimates its authorship. Cowper does not belong to either the transcendental, the spasmodic, the metaphysical, the enigmatical, or the satanic school, but his wonderful power of word-painting, the purity of his sentiments, his association of noble thoughts with common things, his humour, and the tenderness of his sacred poetry, not to speak of his charming letters, will always command for him a high place in the literature of his country.

And thus ends my pilgrimage.

A DESCRIPTION OF THE 24-EDRA HAVING ONLY TRIAD SUMMITS AND FOR FACES ONLY PENTAGONS, HEXAGONS, HEPTAGONS AND OCTAGONS, WHICH ARE REDUCIBLE TO THE REGULAR DODECAEDRON.

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THE tables following are a complete compartment of results obtained by the method expounded in my paper (P) at page 49 of volume xxxvii of these *Proceedings*. They are, like most mathematical results, of no further use than to prove the power of the method, which is here to be measured inversely by the number of repetitions in the processes of the same result. The number of the 24-edra whose labels (P 12) are here given, and of which no two are alike, is 607. Each label has the symbol m_c, shewing that the solid is reducible by the rules in (P) to c different bases, and will be by those rules c times constructed, by operations on the fundamentals 5^{12}, $6^2 5^{12}$, $7^2 5^{14}$, $8^2 5^{16}$, &c. A large number, but far less than half of these repetitions, have occurred and been effaced in the operations on the fundamental 5^{12}, which alone have been performed. I have no doubt that the hundreds of these 24-edra would become thousands, if all the fundamentals were to be handled in the same way.

Of these 607 labels, 203 carry m_1, 213 carry m_2, 79 m_3, 85 m_4, 17 m_5. and 10 m_6.

All the figures are before me, as well as those of nearly two hundred 23-edra, 22-edra, &c., which have had to be constructed. Their number shuts out all idea of engraving them. I give the 24-edra, because they are required in

answer to a question in *The Educational Times*, in which there is not space for a solution.

The labels will be intelligible to the reader of (P). Under each partition A, B, &c., of 132, after the proper name in symmetry, come the symbols of the frames, then m_c, and next the window-symbol (P 21). All the 5-gons are to be found in the frames and windows. I have not thought it necessary to give the wallings of the frames, except in part, where it was required to distinguish by them labels having like frames and windows. For this purpose I have also used compared enumerations of like edges AB, of like summits ABC, and sometimes the circuits about like faces. See, for example, the labels I, 20, and I, 21, in which one solid has and the other has not a 7-gon whose circuit is 5555555. Here = means, is bounded by. In the same labels the note $8_1 = 3$ means that the 8-gon wall has one ray-point in three different frames. Other labels of other solids may be found exactly like some of these; but they will differ in their fundamentals, and other distinctions will easily be marked on the figures.

The abbreviations used are the following:—

Az., for azonal or zoneless;

Zo., for zoned or zonal;

Asym., for asymmetrical;

2-*ple*, 3-*ple*, &c., count the repetition of configuration in revolution about a zoneless axis;

Monch., for Monarchaxine;

Tetrarch., for Tetrarchaxine;

Triax., for Triaxine;

Moz., for Monozone;

Mox., for Monaxine;

Hetz., for Heterozone;

Het., for Heteroid (not janal).

Hom., for Homozone.

Zoneless polar edges are written $(AA)^2$, the index denoting 2-ple repetition.

I have omitted the 6 in the suffix of the frame symbols, 4_{006} and 4_{0006}.

The method explained in (P) is accurate and sufficient in its rules for the direct construction of the thousands of these 24-edra, or $(24 + x)$-edra.

I am not sure that these results would be worth recording, if the connexion of the limited question which they so far answer with the names of the French Academy and of Professor Cayley, had not made it worth separately solving. The complete Theory of the Polyedra I have given elsewhere.

Of the five classes P_{24}, $P_{24}\dagger$, $R_{24}\dagger$, R_{24}, and S_{24}, only the first two here occur. Of the second class are P 36, P 43, P 46, P 76, of which the first will supply two, and the others each one, to the class $R_{25}\dagger =$ Vid. (P 21).

A. $8^4 5^{20}$.

1. Hom. Triax. $i10_{10}\, i10_{10}$, m_1, $680^5 0^7$, $88^2 = 4$.

B. $8^3 765^{19}$.

1. Moz. $1_8 3_5 3_5 4_{000}$, m_1, $460^4 0^2$.
2. Moz. $i10_9$, $i10_{10}$; m_1, $680^5 0^3$.
3. Asym. $i9_9$, $i7_8$; m_1, $W = 2$.

C. $8^3 6^3 5^{18}$.

1. Moz. 5_6, 7_8; m_1, $W = 4$; $860^2 0^4$.
2. Asym. $i6_7$, $i7_8$; m_1, $W = 3$.

D. $8^2 7^2 6^2 5^{18}$.

1. 2zo. Mox. Het. $i8_8$, $i10_{10}$; m_1, $880^4 0^4$, $480^6 0^2$.
2. 2-ple Mox. Het. $1_8 1_8 1_8 1_8 2_4$; m_2, $W = 11$, $55^2 = 2$.
3. ,, ,, ,, 4_{00}, $i4_{00}$, $i4_{00}$; m_8, $66^2 = 1 = 55^2$.
4. ,, ,, ,, 4_{00}, $i4_{000}$, $i4_{000}$; $m4$, $66^2 = 1 = 55^2$.

5.	2-ple Mox. Het.	$i10_9,\ i10_9;\ m_1,$	$88^2=1=77^2.$
6.	,, ,, ,,	$i7_8,\ i7_8;\ m_2,\ W=2,$	$88^2=1=77^2.$
7.	,, ,, ,,	$i9_9,\ i9_9;\ m_1,$	$88^2=1=66^2.$
8.	,, ,, ,,	$i9_9,\ i9_9;\ m_1,$	$88^2=1=77^2.$
9.	Asym.	$i9_9,\ i7_8;\ m_1,\ W=1,$	$86=3.$
10.	,,	$i9_9,\ i7_8;\ m_1,\ W=1,$	$86=1.$
11.	,,	$i9_9,\ i7_8;\ m_1,\ W=1,$	$86=2.$
12.	,,	$1_8,\ i3_5,\ 4_{000};\ m_1,\ W=112.$	
13.	,,	$i8_8,\ i9_9;\ m_2,\ W=1.$	
14.	,,	$1_8,\ i8_8,\ i6_7;\ m_1.$	
15.	,,	$6_7,\ 6_7;\ m_2,\ W=4.$	

E. $8^2 7 6^4 5^{17}$.

1.	Moz.	$i10_9,\ i8_8;\ m_1;$	$880^40^4.$
2.	,,	$i9_9,\ i6_7;\ m_1,\ W=1;$	$880^40^4.$
3.	,,	$i8_8,\ i7_8;\ m_1,\ W=1;$	$680^50^3.$
4.	,,	$1_8,\ 1_8,\ 1_8,\ 1_8;\ m_1,\ W=11111;$	$440^20^2.$
5.	,,	$3_5,\ 3_5,\ 3_5;\ m_2,\ W=2;$	$6400^3.$
6.	Asym.	$i8_8,\ i9_9;\ m_4.$	
7.	,,	$i9_9,\ i6_7;\ m_1,\ W=1.$	
8.	,,	$i8_8,\ i7_8;\ m_2,\ W=1.$	
9.	,,	$i8_8,\ i6_7;\ m_2,\ W=2.$	
10.	,,	$i8_8,\ i7_9;\ m_3.$	
11.	,,	$i6_7,\ i7_8;\ m_1,\ W=2.$	
12.	,,	,, ,, ; $m_1,\ W=11.$	
13.	,,	$i7_8,\ i7_8;\ m_4,\ W=1,$	$886=0.$
14.	,,	,, ,, ; $m_4,\ W=1,$	$886=1.$
15.	,,	$i8_8,\ i5_7;\ m_1,\ W=2.$	
16.	,,	$1_8,\ 1_8,\ 1_8,\ i4_{00};\ m_3,\ W=11.$	
17.	,,	$1_8,\ 1_8,\ i4_{000};\ m_2,\ W=113.$	
18.	,,	,, ,, ,, ; $m_2,\ W=122.$	
19.	,,	$1_8,\ 2_4,\ i4_{00};\ m_1,\ W=13,$	$78=0.$
20.	,,	,, ,, ,, ; $m_1,\ W=13,$	$78=1.$
21.	,,	,, ,, ,, ; $m_1,\ W=4.$	

22.	Asym.	1_3, 2_4, $i4_{000}$;	m_1, W = 4.	
23.	,,	3_5, $i3_5$, $i4_{00}$;	m_2, W = 4.	
24.	,,	5_6, 7_8, 1_3;	m_1.	
25.	,,	$i4_{00}$, $i4_{000}$;	m_5, W = 14.	
26.	,,	$i4_{000}$, $i4_{000}$;	m_6, W = 23.	
27.	,,	$i3_5$, $i4_{000}$;	m_2, W = 15.	
28.	,,	3_5, $i3_5$, $i3_5$;	m_5, W = 2.	
29.	,,	1_3, 1_3, $i4_{00}$;	m_2, W = 122.	

F. $8^2 6^6 5^{16}$.

1.	2p. Mox. Moz.	$i8_8$, $i8_8$;	m_2,	$480^6 0^2$, $66^2 = 2$.
2.	Moz.	$i9_9$, $i6_7$;	m_1,	$880^4 0^4$.
3.	,,	$i3_5$, $i3_5$, $i4_{000}$;	m_2,	$260^5 0$.
4.	2p. Mox. Het.	$i7_8$, $i7_8$;	m_2,	$88^2 = 1 = 66^2$.
5.	,, ,,	$i3_5$, $i3_5$, $i4_{00}$;	m_2,	$55^2 = 1 = 66^2$.
6.	,, ,,	1_3, 1_3;	m_1, W = 244,	$55^2 = 1 = 66^2$.
7.	,, ,,	$i4_{00}$, $i4_{00}$;	m_2, W = 4,	$55^2 = 1 = 66^2$.
8.	Asym.	$i7_8$, $i5_7$;	m_2, W = 1.	
9.	,,	$i4_{00}$, $i4_{00}$;	m_4, W = 4.	
10.	,,	$i3_5$, $i4_{000}$;	m_2, W = 113.	
11.	,,	1_3, 2_4, $i4_{000}$;	m_1, W = 12.	
12.	,,	1_3, $i3_5$;	m_1, W = 26.	
13.	,,	1_3, 1_3, 3_5;	m_2, W = 23.	
14.	,,	1_3, $i3_5$, $i4_{000}$;	m_1, W = 11.	
15.	,,	1_3, 1_3, $i4_{000}$;	m_2, W = 112	
16.	,,	,, ,, ,, ;	m_2, W = 4.	
17.	,,	1_3, $i4_{00}$, $i4_{00}$;	m_1, W = 1.	
18.	,,	1_3, 1_3, $i4_{00}$;	m_2, W = 22,	86 = 5.
19.	,,	,, ,, ,, ;	m_2, W = 22,	86 = 4.
20.	,,	,, ,, ,, ;	m_2, W = 13.	
21.	,,	1_3, 1_3, 1_3, 1_3;	m_4, W = 112.	

G. $8 7^4 6 5^{18}$.

1.	Moz.	$i10_9$, $i10_9$;	m_2,	$880^4 0^4$.

2. Moz.	$i9_9$, $i10_9$;	m_1,		$880_4 0_4$.
3. Asym.	6_7, 6_7, 1_8;	m_2, W=1.		

H. $87^8 6^8 5^{17}$.

1.	Moz.	$i10_9$, $i8_8$;	m_2,	$680^5 0^8$.	
2.	,,	$i9_9$, $i8_8$;	m_8,	$680^5 0^8$.	
3.	,,	1_8, 1_8, 1_8, 4_{000};	m_2, W=11,	$460^4 0^2$,	86=2.
4.	,,	,, ,, ,, ,, ;	m_2, W=11,	,,	86=1.
5.	,,	1_8, 2_4, 2_4, 4_{000};	m_1,	,,	
6.	,,	3_5, 3_5, $i3_5$;	m_2, W=11,	$260^5 0$.	
7.	Asym.	$i9_9$, $i8_8$;	m_8.		
8.	,,	$i9_9$, $i7_8$;	m_1.		
9.	,,	$i8_8$, $i7_8$;	m_8, W=1,		87=1.
10.	,,	,, ,, ;	m_8, W=1,		87=2.
11.	,,	$i9_9$, $i6_7$;	m_1, W=1.		
12.	,,	$i8_8$, $i6_8$;	m_2, W=1.		
13.	,,	$i7_8$, $i7_8$;	m_4, W=1,	777=1=87.	
14.	,,	,, ,, ;	m_4, W=1,	777=0,	87=1.
15.	,,	,, ,, ;	m_4, W=1,	86=1,	87=2.
16.	,,	,, ,, ;	m_4, W=1,	86=2,	87=2.
17.	,,	$i7_8$, $i6_8$;	m_2, W=1.		
18.	,,	$i8_8$, $i6_7$;	m_1, W=2.		
19.	,,	6_7, 6_7, 1_8;	m_2.		
20.	,,	6_7, 6_7;	m_2, W=3.		
21.	,,	1_8, 1_8, 1_8, 4_{00};	m_3, W=11.		
22.	,,	3_5, $i3_5$, 4_{000};	m_8, W=1.		
23.	,,	$i3_5$, $i4_{00}$;	m_2, W=24.		
24.	,,	1_8, 1_8, 2_4, 3_5;	m_2, W=2.		
25.	,,	,, ,, ,, ,, ;	m_2, W=11.		
26.	,,	1_8, 1_8, 3_5;	m_2, W=24.		
27.	,,	1_8, 1_8, 1_8, 2_4;	m_8, W=13.		
28.	,,	3_5, $i3_5$, 4_{00};	m_8, W=1.		
29.	,,	$i4_{00}$, $i4_{000}$;	m_5, W=23,		87=1.
30.	,,	,, ,, ;	m_5, W=23,		87=0.

31.	Asym.	$i4_{00}, i4_{000}$;	m_5, W=14.
32.	,,	$i4_{000}, i4_{000}$;	m_6, W=23.
33.	,,	$3_5, 3_5, 3_5$;	m_3, W=2.
34.	,,	$1_8, i4_{000}, i4_{000}$;	m_1, W=2.
35.	,,	$3_5, i4_{00}$;	m_1, W=24.
36.	,,	$1_8, 2_4, i4_{00}$;	m_1, W=22.
37.	,,	,, ,, ,, ;	m_1, W=112.
38.	,,	$1_8, 3_5, i4_{00}$;	m_1, W=12.
39.	,,	$1_8, 4_{00}, 4_{00}$;	m_1, W=11.

I. $8 7^2 6^5 5^{16}$.

1.	Moz.	$i8_8, i6_7$;	m_1, W=1,	$680^5 0^3$.
2.	,,	$1_8, 1_8, 1_8, 1_8, 2_4$;	m_3,	$660^3 0^3$.
3.	,,	$1_8, 1_8, 2_4, 2_4$;	m_1, W=2.	$440^2 0^2$.
4.	,,	$1_8, 2_4, 2_4, 3_5$;	m_1,	$460^4 0^2$.
5.	,,	$5_6, 7_8$;	m_1, W=11.	$860^2 0^4$.
6.	Asym.	$i8_8, i5_7$;	m_1, W=1.	
7.	,,	$i8_8, i7_8$;	m_3,	87=2.
8.	,,	,, ,, ;	m_3,	87=1.
9.	,,	,, ,, ;	m_2.	
10.	,,	$i8_8, i6_7$;	m_3, W=1,	666=1.
11.	,,	,, ,, ;	m_3, W=1,	666=0.
12.	,,	,, ,, ;	m_1, W=1.	
13.	,,	$i8_8, i4_{000}$;	m_2, W=2.	
14.	,,	$1_8, 1_8, 1_8, 2_4$;	m_3, W=12,	86=0, 87=0.
15.	,,	,, ,, ,, ,, ;	m_3, W=12,	86=0, 87=1.
16.	,,	,, ,, ,, ,, ;	m_3, W=12,	86=1, 87=0.
17.	,,	,, ,, ,, ,, ;	m_3, W=111.	
18.	,,	$1_8, 1_8, 1_8, 1_8$;	m_4, W=13,	$8_1=2$, 77=0.
19.	,,	,, ,, ,, ,, ;	m_4, W=13,	$8_1=2$, 77=1.
20.	,,	,, ,, ,, ,, ;	m_4, W=13,	$8_1=3$, $7=5^7$.
21.	,,	,, ,, ,, ,, ;	m_4, W=13,	$8_1=3$, 7 ± 5^7.
22.	,,	,, ,, ,, ,, ;	m_4, W=112.	
23.	,,	$1_8, 1_8, 1_8, i3_5$;	m_3, W=11.	

24. Asym. 1_8, 1_8, $i3_5$; m_2, W=23, 77=0.
25. ,, ,, ,, ,, ; m_2, W=23, $5_0 6_2 5_0 7_1 7_1 6_1$, 77=1.
26. ,, ,, ,, ,, ; m_2, W=23, $5_0 6_2 6_0 7_1 6_1 6_1$, 77=1.
27. ,, ,, ,, ,, ; m_2, W=122.
28. ,, ,, ,, ,, ; m_2, W=11111.
29. ,, 1_8, 1_8, 3_5; m_2, W=5.
30. ,, ,, ,, ,, ; m_2, W=122.
31. ,, 1_8, 1_8, 2_4, 3_5; m_2, W=1, 86=0.
32. ,, ,, ,, ,, ,, ; m_2, W=1, 86=1.
33. ,, $i4_{000}$, $i4_{000}$; m_6, W=4.
34. ,, ,, ,, ; m_6, W=13.
35. ,, 1_8, 1_8, 2_4; m_2, W=1122.
36. ,, ,, ,, ,, ; m_2, W=123, $8=65^2 65^4$.
37. ,, ,, ,, ,, ; m_2, W=123, $8=65^3 65^3$.
38. ,, 1_8, 1_8, 2_4, 2_4; m_2, W=11, 87=1.
39. ,, ,, ,, ,, ,, ; m_2, W=11, 87=0.
40. ,, 1_8, 1_8, $i4_{00}$; m_2, W=112, 77=0.
41. ,, ,, ,, ,, ; m_2, W=112, $8=6565^5$, 77=1.
42. ,, ,, ,, ,, ; m_2, W=112, $8=65^3 65^3$, 77=1.
43. ,, ,, ,, ,, ; m_2, W=22.
44. ,, ,, ,, ,, ; m_2, W=13.
45. ,, ,, ,, ,, ; m_2, W=4.
46. ,, 1_8, 1_8, $i4_{000}$; m_2, W=112, 86=2, 76=2.
47. ,, ,, ,, ,, ; m_2, W=112, 86=2, 76=3.
48. ,, ,, ,, ,, ; m_2, W=112, 86=1.
49. ,, ,, ,, ,, ; m_2, W=13.
50. ,, 1_8, 2_4, 2_4; m_1, W=122.
51. ,, 1_8, $i4_{00}$; m_1, W=124, 87=0, 866=0, 776=0.
52. ,, ,, ,, ; m_1, W=124, 87=0, 866=1, 776=0.
53. ,, ,, ,, ; m_1, W=124, 776=1.
54. ,, ,, ,, ; m_1, W=124, 87=1.
55. ,, ,, ,, ; m_1, W=223.
56. ,, 1_8, 2_4, $i4_{000}$; m_1, W=12.
57. ,, 1_8, 2_4, 4_{000}; m_1, W=12.

58.	Asym.	$1_3, 2_4, i4_{00}$;	m_1, W=3.	
59.	,,	$1_3, 2_4, i3_5$;	m_1, W=13.	
60.	,,	,, ,, ,, ;	m_1, W=112.	
61.	,,	$1_3, 1_3, 2_4$;	m_2, W=6.	
62.	,,	$1_3, 3_5, i3_5$;	m_1, W=3.	
63.	,,	,, ,, ,, ;	m_1, W=12.	
64.	,,	$i3_5, i4_{00}$;	m_2, W=5,	87=1.
65.	,,	,, ,, ;	m_2, W=5,	87=0.
66.	,,	,, ,, ;	m_2, W=23,	666=0, 86=1.
67.	,,	,, ,, ;	m_2, W=23,	666=1, 86=1.
68.	,,	,, ,, ;	m_2, W=23,	86=0.
69.	,,	,, ,, ;	m_2, W=23,	77=0, 86=2.
70.	,,	,, ,, ;	m_2, W=23,	77=1, 86=2.
71.	,,	,, ,, ;	m_2, W=14.	
72.	,,	,, ,, ;	m_2, W=122.	
73.	,,	$i3_5, i4_{000}$;	m_2, W=5.	
74.	,,	,, ,, ;	m_2, W=14,	766=0, 78=0.
75.	,,	,, ,, ;	m_2, W=14,	766=1, 78=1.
76.	,,	,, ,, ;	m_2, W=14,	766=1, 78=0.
77.	,,	,, ,, ;	m_2, W=23.	
78.	,,	,, ,, ;	m_2, W=122.	
79.	,,	$3_5, i3_5$;	m_3, W=24.	
80.	,,	$3_5, 3_5, i3_5$;	m_4, W=1,	$6_0 6_2 8_0 6_1 7_1 6_1$.
81.	,,	,, ,, ,, ;	m_4, W=1,	$5_0 6_2 6_0 8_1 6_1 7_1$.
82.	,,	$i3_5, i3_5$;	m_4, W=123.	
83.	,,	$i4_{00}, i4_{00}$;	m_4, W=4,	87=0.
84.	,,	,, ,, ;	m_4, W=4,	87=1.
85.	,,	,, ,, ;	m_4, W=13,	766=1, 86=1.
86.	,,	,, ,, ;	m_4, W=13,	766=3, 86=1.
87.	,,	,, ,, ;	m_4, W=13,	86=3.
88.	,,	$i4_{00}, i4_{000}$;	m_5, W=112.	
89.	,,	,, ,, ;	m_5, W=13,	76=4, 86=1.
90.	,,	,, ,, ;	m_5, W=13,	76=4, 86=2.
91.	,,	,, ,, ;	m_5, W=13,	76=3.

92. Asym. $i4_{00}$, $i4_{000}$; m_5, W=13, 76=6.
93. ,, ,, ,, ; m_5, W=22.
94. ,, $i7_8$, $i7_8$; m_4, 77=0.
95. ,, ,, ,, ; m_4, 77=1.
96. ,, $i7_8$, $i5_7$; m_2, W=1, 666=0.
97. ,, ,, ,, ; m_2, W=1, 666=1.
98. ,, 1_8, $i4_{000}$; m_1, W=34.
99. ,, ,, ,, ; m_1, W=124, 866=1.
100. ,, ,, ,, ; m_1, W=124, 866=0.
101. ,, 1_8, 3_5, 3_5 ; m_1, W=12.

J. $876^7 5^{15}$.

1. Moz. 2_4, 3_5 ; m_1, W=33, $460^4 0^2$.
2. Mor. $i3_5$, $i3_5$; m_2, W=1112, $440^8 0^2$.
3. Asym. 1_8, 1_8, 1_8, 1_8 ; m_4, W=111.
4. ,, 1_8, 1_8, 1_8 ; m_8, W=123, 667=1, 86=2, 76=3.
5. ,, ,, ,, ,, ; m_8, W=123, 667=1, 86=2, 76=2.
6. ,, ,, ,, ,, ; m_8, W=123, 667=0, 86=2.
7. ,, ,, ,, ,, ; m_8, W=123, 66=70, 86=1, 8_1=3.
8. ,, ,, ,, ,, ; m_8, W=123, 667=0, 86=1, 8_1=2.
9. ,, ,, ,, ,, ; m_8, W=24, 667=2.
10. ,, ,, ,, ,, ; m_8, W=24, 667=1.
11. ,, ,, ,, ,, ; m_8, W=114.
12. ,, ,, ,, ,, ; m_8, W=6.
13. ,, 1_8, 1_8, 1_8, 2_4 ; m_8. W=11, 86=2.
14. ,, ,, ,, ,, ,, ; m_8, W=11, 86=1.
15. ,, 1_8, 1_8 ; m_2, W=234.
16. ,, ,, ,, ; m_2, W=126.
17. ,, 1_8, 1_8, 3_5 ; m_2, W=112.
18. ,, ,, ,, ,, ; m_2, W=13.
19. ,, 1_8, 1_8, 2_4 ; m_2, W=5.
20. ,, ,, ,, ,, ; m_2, W=23, 86=1.
21. ,, ,, ,, ,, ; m_2, W=23, 86=2.
22. ,, ,, ,, ,, ; m_2, W=1112, 86=1.

23.	Asym.	$1_8, 1_8, 2_4; m_2$, W=1112,	86=2.
24.	,,	,, ,, ,, ; m_2, W=122,	86=1.
25.	,,	,, ,, ,, ; m_2, W=122,	76=3, 86=2.
26.	,,	,, ,, ,, ; m_2, W=122,	76=2, 86=2.
27.	,,	,, ,, ,, ; m_2, W=14.	
28.	,,	$1_8, 1_8, i4_{000}; m_2$, W=111.	
29.	,,	$1_8, 1_8, i4_{00}; m_2$, W=111.	
30.	,,	$1_8, 1_8, i3_5; m_2$, W=13,	666=1, 86=1.
31.	,,	,, ,, ,, ; m_2, W=13,	666=1, 86=2.
32.	,,	,, ,, ,, ; m_2, W=13,	666=0.
33.	,,	,, ,, ,, ; m_2, W=13,	666=2.
34.	,,	,, ,, ,, ; m_2, W=112,	$6=76^5$, 866=1.
35.	,,	,, ,, ,, ; m_2, W=112,	$6=76^5$, 866=0.
36.	,,	,, ,, ,, ; m_2, W=112,	6 ± 76^5.
37.	,,	,, ,, ,, ; m_2, W=4.	
38.	,,	$5_6, 1_8, i3_5; m_1$, W=1.	
39.	,,	$1_8, 2_2, i3_5; m_1$, W=12,	666=0, $6=85^2 75^2$.
40.	,,	,, ,, ,, ; m_1, W=12,	666=0, $6\pm85^2 75^2$.
41.	,,	,, ,, ,, ; m_1, W=12,	666=2.
42.	,,	,, ,, ,, ; m_1, W=111.	
43.	,,	$1_8, 2_4, 3_5; m_1$, W=12,	666=3.
44.	,,	,, ,, ,, ; m_1, W=12,	666=2.
45.	,,	$1_8, 2_4, i4_{00}; m_1$, W=11.	
46.	,,	$1_8, 3_5, i3_5; m_1$, W=11.	
47.	,,	$1_8, 2_4; m_1$, W=125.	
48.	,,	,, ,, ; m_1, W=134.	
49.	,,	$1_8, i3_5; m_1$, W=25,	766=0.
50.	,,	,, ,, ; m_1, W=25,	766=1.
51.	,,	,, ,, ; m_1, W=223.	
52.	,,	,, ,, ; m_1, W=16.	
53.	,,	,, ,, ; m_1, W=34.	
54.	,,	$1_8, i3_5, i3_5; m_1$, W=11.	
55.	,,	$2_4, i3_5; m_1$, W=15,	76=3.
56.	,,	,, ,, ; m_1, W=15,	76=4.

57.	Asym.	5_6, 2_4, $i3_5$; m_1.	
58.	,,	3_5, $i3_5$; m_8, W=23,	$8_6 6_2 5_0 7_1 6_1 6_1$.
59.	,,	,, ,, ; m_8, W=23,	$6_0 6_2 5_0 7_1 8_1 6_1$.
60.	,,	,, ,, ; m_8, W=23,	$5_0 6_2 6_0 6_1 7_1 6_1$.
61.	,,	$i3_5$, $i3_5$; m_4, W=5.	86=2.
62.	,,	,, ,, ; m_4, W=5,	86=3.
63.	,,	,, ,, ; m_4, W=1112.	
64.	,,	$i3_5$, $i4_{00}$; m_4, W=22,	$5_0 6_2 8_0 6_1 6_1 6_1$, 866=1.
65.	,,	,, ,, ; m_4, W=22,	$5_0 6_2 8_0 6_1 6_1 6_1$, 866=0.
66.	,,	,, ,, ; m_4, W=22,	$5_0 6_2 6_0 6_1 8_1 6_1$, 766=1.
67.	,,	,, ,, ; m_4, W=22,	$5_0 6_2 6_0 6_1 8_1 6_1$, 766=0.
68.	,,	,, ,, ; m_4, W=22,	$5_0 6_2 6_0 8_1 6_1 6_1$.
69.	,,	,, ,, ; m_4, W=22,	$5_0 6_2 5_0 8_1 6_1 6_1$.
70.	,,	,, ,, ; m_4, W=112.	
71.	,,	,, ,, ; m_4, W=4.	
72.	,,	$i3_5$, $i3_5$, $i3_5$; m_6.	
73.	,,	$i3_5$, $i4_{000}$; m_2, W=4.	
74.	,,	,, ,, ; m_2, W=112.	
75.	,,	,, ,, ; m_2, W=22,	866=0.
76.	,,	,, ,, ; m_2, W=22,	866=1.
77.	,,	$i4_{00}$, $i4_{00}$; m_4, W=3,	666=0.
78.	,,	,, ,, ; m_4, W=3,	666=3.
79.	,,	,, ,, ; m_4, W=3,	76=3, 666=1.
80.	,,	,, ,, ; m_4, W=3,	76=2, 666=1.
81.	,,	,, ,, ; m_4, W=3,	76=4, 666=1.
82.	,,	,, ,, ; m_4, W=3,	666=5.
83.	,,	,, ,, ; m_4, W=12,	76=4.
84.	,,	,, ,, ; m_4, W=12,	76=3.
85.	,,	$i4_{000}$, $i4_{000}$; m_6, W=3.	
86.	,,	,, ,, ; m_6, W=12.	
87.	,,	5_6, $i3_5$; m_1, W=22.	
88.	,,	1_8, $i4_{000}$; m_1, W=24.	
89.	,,	,, ,, ; m_1, W=123.	

K. 86^95^{14}.

1.	Moz.	$1_8, 1_8$;	m_1, W=1133,	260^50.
2.	Asym.	$1_8, 1_8, 2_4$;	m_2, W=112,	$6=56^5$.
3.	,,	$1_8, 1_8, 2_4$;	m_2. W=112,	6 ± 56^5.
4.	,,	$1_8, 1_8, i3_5$;	m_2, W=12,	$8=6565^5$.
5.	,,	,, ,, ,, ;	m_2, W=12,	$8=65^265^4$.
6.	,,	,, ,, ,, ;	m_2, W=111.	
7.	,,	$1_8, 1_8, 1_8$;	m_3, W=113.	
8.	,,	$1_8, 2_4$;	m_1, W=25.	
9.	,,	$1_8, i3_5$;	m_1, W=1122.	
10.	,,	,, ,, ;	m_1, W=33.	
11.	,,	,, ,, ;	m_1, W=123.	
12.	,,	,, ,, ;	m_1, W=24.	
13.	,,	$2_4, i3_5$;	m_1, W=122,	$668=1$.
14.	,,	,, ,, ;	m_1, W=122,	$668=0$.
15.	,,	$i3_5, i3_5$, ;	m_4, W=22.	
16.	,,	$1_8, 2_4, i3_5$;	m_1, W=11.	

L. 7^35^{18}.

1.	2zo. Mox. Het.	$6_7, 6_7, 2_4$; m_1,	880^40^4, 440^20^2.
2.	2p. Mox. Moz.	$i9_9, i9_9$; m_1,	880^40^4, $77^2=2$.
3.	3zo. Monch. Hetz.	$1_8, 1_8, 2_4, 2_4, 2_4$; m_1,	4 zones all 660^30^3.
4.	3zo. Monch. Hom.	$i10_9, i10_9$; m_1,	880^40^4, $77^2=6$.

M. $7^56^25^{17}$.

1.	Asym.	$1_8, 1_8, 2_4, 4_{00}$;	m_2, W=1.
2.	,,	$1_8, 1_8, 2_4, 3_5$;	m_2, W=2.
3.	,,	$1_8, 3_5, 3_5$;	m_1, W=22.
4.	,,	$i8_8, i7_8$;	m_2, W=1.
5.	,,	$i4_{00}, i4_{000}$;	m_5, W=23.
6.	,,	$1_8, 3_5, i3_5$;	m_1, W=22.

N. $7^46^45^{16}$.

1.	2p. Mox. Het.	$6_7, 6_7$; m_1, W=2,	$66^2, =1=55^2$.

2.	2p. Mox. Het.	6_7, 6_7 ;	m_1,	W=2,	$55^2=2$.
3.	,, ,, ,,	,, ,, ;	m_1,	W=11,	$55^2=66^2=1$.
4.	,, ,, ,,	2_4, 2_4, 2_4 ;	m_2,	W=22,	$55^2=2$.
5.	,, ,, ,,	1_3, 1_3, 1_3, 1_3 ;	m_2,	W=4,	$55^2=2$.
6.	,, ,, ,,	$i7_8$, $i7_8$;	m_2,		$77^2=2$.
7.	,, ,, ,,	$i8_8$, $i8_8$;	m_2,		$77^2=2$.
8.	,, ,, ,,	$i4_{000}$, $i4_{000}$;	m_3,	W=22,	$77^2=1=66^2$.
9.	,, ,, ,,	,, ,, ;	m_3,	W=4,	$66^2=1=77^2$.
10.	,, ,, ,,	$i4_{00}$, $i4_{00}$;	m_2,	W=4,	$66^2=1=55^2$.
11.	,, ,, ,,	1_3, 1_3, 4_{00} ;	m_1,	W=112,	$55^2=2$.
12.	Az. Triax.	$i8_8$, $i8_8$;	m_2,		$77^2=2=66^2=55^2$.
13.	Hom. Triax.	$i8_8$, $i8_8$;	m_1,		680^50^3, $77^2=4$.
14.	2zo. Mox. Het.	1_3, 1_3, 2_4 ;	m_1,	W=33,	660^30^3, 660^30^3.
15.	2p. Mox. Moz.	1_3, 1_3, 1_3, 1_3 ;	m_1,	W=22,	440^20^2, $55^2=2$.
16.	,, ,, ,,	6_7, 6_7 ;	m_1,	W=11,	880^40^4, $77^2=2$.
17.	Moz.	1_3, 1_3, 2_4 ;	m_1,	W=33,	660^30^3.
18.	,,	5_6, 3_5, $i3_5$;	m_1,		460^40^2.
19.	Asym.	$i8_8$, $i6_7$;	m_2,	W=1.	
20.	,,	$i7_8$, $i5_7$;	m_1,	W=1.	
21.	,,	$i4_{00}$, $i4_{00}$;	m_4,	W=22.	
22.	,,	,, ,, ;	m_4,	W=4.	
23.	,,	,, ,, ;	m_4,	W=13.	
24.	,,	$i3_5$, $i4_{000}$;	m_2,	W=14,	$77=2$.
25.	,,	,, ,, ;	m_2,	W=14,	$77=3$.
26.	,,	1_3, 3_5, $i3_5$;	m_1,	W=12.	
27.	,,	1_3, 1_3, 3_5 ;	m_2,	W=23,	$76=3$.
28.	,,	,, ,, ,, ;	m_2,	W=23,	$76=5$.
29.	,,	,, ,, ,, ;	m_2,	W=23,	$76=6$.
30.	,,	3_5, 3_5, $i3_5$;	m_4,	W=1.	
31.	,,	$i3_5$, $i3_5$;	m_4,	W=6.	
32.	,,	$i4_{00}$, $i4_{000}$;	m_5,	W=13.	
33.	,,	,, ,, ;	m_5,	W=22.	
34.	,,	,, ,, ;	m_5,	W=4.	
35.	,,	1_3, 1_3, 1_3, 2_4 ;	m_3,	W=12.	

36.	Asym.	$1_3, 1_3, i4_{00}; m_2$, W=112.	
37.	,,	$1_3, 1_3, 1_3, 3_5; m_3$, W=11,	66=1.
38.	,,	,, ,, ,, ,,; m_2, W=11,	66=2.
39.	,,	,, ,, ,, ,,; m_3, W=11,	66=0.
40.	,,	$1_3, 2_4, 3_5; m_1$, W=112.	
41.	,,	,, ,, ,,; m_1, W=22.	
42.	,,	,, ,, ,,; m_1, W=13.	
43.	,,	$1_3, i3_5; m_1$, W=26.	
44.	,,	$1_3, 3_5; m_1$, W=26.	
45.	,,	$1_3, 1_3, i3_5; m_2$, W=122.	
46.	,,	$1_3, i4_{00}; m_1$, W=34.	
47.	,,	$i4_{000}, i4_{000}; m_6$, W=13.	
48.	,,	$1_3, 2_4, i4_{00}; m_1$, W=3.	
49.	,,	$1_3, 1_3, i4_{000}; m_2$, W=112.	
50.	,,	$5_6, 1_3, i3_5; m_1$, W=2.	
51.	,,	$3_5, i4_{00}; m_1$, W=23.	
52.	,,	$i3_5, i4_{00}; m_2$, W=5.	
53.	,,	$3_5, i3_5, ; m_6$, W=24.	
54.	,,	$2_4, 2_4, 3_5; m_2$, W=3.	
55.	,,	$1_3, 3_5, i4_{000}; m_1$, W=11.	

O. $7^3 6^6 5^{15}$.

1.	3zo. Mox. Het.	$1_3, 1_3, 1_3, 1_3, 1_3; m_3$,	$660^3 0^3$.
2.	Moz.	$1_3, 1_3, 1_3, 1_3, 1_3; m_3$,	$260^5 0$.
3.	,,	$i3_5, i3_5, ; m_2$, W=14,	$440^2 0^2$.
4.	,,	,, ,, ; m_2, W=5,	$440^2 0^2$.
5.	,,	$1_3, 1_3, 1_3, 2_4; m_2$, W=2,	$660^3 0^3$.
6.	,,	$i8_3, i6_7; m_1$,	$680^5 0^3$.
7.	,,	$i4_{000}, i4_{000}; m_3$, W=3,	$440^2 0^2$.
8.	Asym.	$1_3, 1_3, 1_3; m_3$, W=33.	
9.	,,	,, ,, ,,; m_3, W=114,	76=4.
10.	,,	,, ,, ,,; m_3, W=114,	76=5.
11.	,,	,, ,, ,,; m_3, W=1122.	
12.	,,	,, ,, ,,; m_3, W=24.	

13.	Asym.	$i4_{00}$, $i4_{00}$;	m_4,	W=3,	666=1, 77=2.
14.	,,	,, ,, ;	m_4,	W=3,	666=1, 77=1.
15.	,,	,, ,, ;	m_4,	W=3,	666=0.
16.	,,	,, ,, ;	m_4,	W=12,	666=2, 77=2.
17.	,,	,, ,, ;	m_4,	W=12,	666=2, 77=1.
18.	,,	,, ,, ;	m_4,	W=12,	666=0, 76=6.
19.	,,	,, ,, ;	m_4,	W=12,	666=0, 76=7.
20.	,,	,, ,, ;	m_4,	W=12,	666=0, 76=8.
21.	,,	$i4_{00}$, $i4_{000}$;	m_5,	W=3.	
22.	,,	,, ,, ;	m_5,	W=12,	77=1.
23.	,,	,, ,, ;	m_5,	W=12,	77=0.
24.	,,	$i4_{000}$, $i4_{000}$;	m_6,	W=12,	77=0.
25.	,,	,, ,, ;	m_6,	W=12,	77=2.
26.	,,	1_8, 2_4, 2_4 ;	m_1,	W=22,	$7_1 6_0 5_1 6_0 5_1 6_0$.
27.	,,	,, ,, ,, ;	m_1,	W=22,	$7_1 6_0 5_1 7_0 0_1 6_0$.
28.	,,	,, ,, ,, ;	m_1,	W=13,	$7_1 0_0 7_1 6_0 6_1 6_0$.
29.	,,	,, ,, ,, ;	m_1,	W=13,	$7_1 6_0 6_1 0_0 7_1 5_0$.
30.	,,	1_8, 1_8, $i3_5$;	m_2,	W=112,	$5_0 6_2 6_0 6_1 7_1 7_1$, 666=0.
31.	,,	,, ,, ,, ;	m_2,	W=112,	$6_0 6_2 6_0 7_1 6_1 7_1$.
32.	,,	,, ,, ,, ;	m_2,	W=31,	$7_0 6_2 5_0 6_1 6_1 7_1$.
33.	,,	,, ,, ,, ;	m_2,	W=31,	$5_0 6_2 7_0 6_1 7_1 7_1$.
34.	,,	,, ,, ,, ;	m_2,	W=112,	$6_0 6_2 6_0 7_1 7_1 6_1$.
35.	,,	,, ,, ,, ;	m_2,	W=112,	$5_0 6_2 6_0 6_1 7_1 7_1$, 666=2.
36.	,,	,, ,, ,, ;	m_2,	W=112,	$5_0 6_2 6_0 7_1 7_1 6_1$.
37.	,,	,, ,, ,, ;	m_2,	W=112,	$5_0 6_2 7_0 6_1 6_1 7_1$.
38.	,,	,, ,, ,, ;	m_2,	W=4.	
39.	,,	,, ,, ,, ;	m_2,	W=22.	
40.	,,	1_3, 1_3, 3_5 ;	m_2,	W=13,	666=0.
41.	,,	,, ,, ,, ;	m_2,	W=13,	666=1, 77=1.
42.	,,	,, ,, ,, ;	m_2,	W=13,	666=2, 77=1.
43.	,,	,, ,, ,, ;	m_2,	W=13,	666=2, 77=0.
44.	,,	,, ,, ,, ;	m_2,	W=13,	666=1, 77=0.
45.	,,	,, ,, ,, ;	m_2.	W=4.	
46.	,,	$i3_3$, $i4_{000}$;	m_2,	W=112,	776=1.

47. Asym. $i3_5$, $i4_{000}$; m_2, $W=112$, $776=0$.
48. ,, ,, ,, ; m_2, $W=4$.
49. ,, ,, ,, ; m_2, $W=13$, $660=0$, $76=7$.
50. ,, ,, ,, ; m_2, $W=13$, $666=1$, $76=7$.
51. ,, ,, ,, ; m_2, $W=13$, $76=6$.
52. ,, 1_3, 1_3, $i4_{00}$; m_2, $W=12$, $66=3$.
53. ,, ,, ,, ,, ; m_2, $W=12$, $66=2$.
54. ,, 1_3, 1_3, 4_{00} ; m_2, $W=111$.
55. ,, 1_3, 2_4, $i4_{00}$; m_1, $W=11$.
56. ,, 1_3, 2_4, $i4_{000}$; m_1, $W=11$.
57. ,, 1_3, 1_3 ; m_2, $W=36$.
58. ,, ,, ,, ; m_2, $W=144$.
59. ,, 1_3, 1_3, 2_4 ; m_2, $W=23$, $666=0$, $76=7$.
60. ,, ,, ,, ,, ; m_2, $W=23$, $666=0$, $76=5$.
61. ,, ,, ,, ,, ; m_2, $W=23$, $666=1$.
62. ,, ,, ,, ,, ; m_3, $W=5$.
63. ,, 1_3, $i3_5$; m_1, $W=25$, $5_0 6_2 6_0 6_1 7_1 7_1$.
64. ,, ,, ,, ; m_1, $W=25$, $5_0 6_2 7_0 7_1 6_1 7_1$.
65. ,, ,, ,, ; m_1, $W=25$, $5_0 6_2 7_0 6_1 7_1 7_1$, $6_1 5_0 6_1 5_0 7_1 6_0$.
66. ,, ,, ,, ; m_1, $W=25$, $5_0 6_2 7_0 6_1 7_1 7_1$, $6_1 5_0 6_1 7_0 7_1 5_0$.
67. ,, ,, ,, ; m_1, $W=223$.
68. ,, ,, ,, ; m_1, $W=34$.
69. ,, ,, ,, ; m_1, $W=124$, $66=3$.
70. ,, ,, ,, ; m_1, $W=124$, $66=2$.
71. ,, 1_3, 3_5 ; m_1, $W=34$.
72. ,, ,, ,, ; m_1, $W=16$.
73. ,, 1_3, $i4_{00}$; m_1, $W=123$.
74. ,, ,, ,, ; m_1, $W=24$.
75. ,, 1_3, 3_5, $i3_5$; m_1, $W=2$.
76. ,, $i3_5$, $i3_5$; m_4, $W=14$, $76=7$.
77. ,, ,, ,, ; m_4, $W=14$, $76=6$.
78. ,, ,, ,, ; m_4, $W=23$, $76=7$, $766=2$.
79. ,, ,, ,, ; m_4, $W=23$, $76=7$, $766=0$.
80. ,, ,, ,, ; m_4, $W=23$, $76=3$.

81.	Asym.	$i3_5$, $i3_5$; m_4,	W = 23,	76 = 6.
82.	,,	,, ,, ; m_4,	W = 5,	76 = 7.
83.	,,	,, ,, ; m_4,	W = 5,	76 = 8.
84.	,,	3_5, $i3_5$; m_3,	W = 23,	76 = 6, 766 = 1.
85.	,,	,, ,, ; m_3,	W = 23,	76 = 6, 766 = 2.
86.	,,	,, ,, ; m_3,	W = 23,	76 = 4.
87.	,,	3_5, $i3_5$; m_3,	W = 23,	76 = 5.
88.	,,	,, ,, ; m_3,	W = 23,	76 = 7.
89.	,,	,, ,, ; m_3,	W = 14.	
90.	,,	$i3_5$, $i4_{00}$; m_2,	W = 112,	77 = 1.
91.	,,	,, ,, ; m_2,	W = 112,	77 = 0.
92.	,,	,, ,, ; m_2,	W = 13,	766 = 1.
93.	,,	,, ,, ; m_2,	W = 13,	766 = 2.
94.	,,	,, ,, ; m_2,	W = 13,	766 = 4.
95.	,,	,, ,, ; m_2,	W = 4.	
96.	,,	2_4, $i3_5$; m_1,	W = 24.	
97.	,,	5_6, 1_3, $i3_5$; m_1,	W = 1.	
98.	,,	1_3, 2_4, 3_5 ; m_1,	W = 12,	$5_0 7_2 5_0 7_1 6_1 7_1$.
99.	,,	,, ,, ,, ; m_1,	W = 12,	$5_0 7_2 6_0 7_1 6_1 6_1$.
100.	,,	1_3, 2_4, $i3_5$; m_1,	W = 12,	$7_1 7_0 6_1 6_0 6_1 5_0$.
101.	,,	,, ,, ,, ; m_1,	W = 12,	$7_1 5_0 7_1 0_0 6_1 6_0$.
102.	,,	,, ,, ,, ; m_1,	W = 12,	$7_1 5_0 6_1 0_0 7_1 6_0$.
103.	,,	,, ,, ,, ; m_1,	W = 12,	$7_1 5_0 7_1 0_0 6_1 5_0$.
104.	,,	,, ,, ,, ; m_1,	W = 3.	
105.	,,	1_3, $i3_5$, $i3_5$; m_1,	W = 11,	77 = 1.
106.	,,	,, ,, ,, ; m_1,	W = 11,	77 = 0.
107.	,,	2_4, 2_4 ; m_2,	W = 25.	
108.	,,	2_4, 2_4, 2_4 ; m_3,	W = 12.	
109.	,,	1_3, 2_4 ; m_1,	W = 125.	
110.	,,	1_3, 1_3, 1_3, 2_4 ; m_3,	W = 11.	

P. $7^2 6^8 5^{14}$.

1.	2p. Mx. Ht.	$i3_5$, $i3_5$; m_2,	W − 22,	$77^2 = 1 = 66^2$.
2.	,, ,, ,,	,, ,, ; m_2,	W = 22,	$66^2 = 1 = 55^2$.

3. 2p. Mx. Ht. $i3_5, i3_5$; m_2, W = 112, $66^2 = 1 = 55^2$.
4. „ „ „ $i4_{00}, i4_{00}$; m_2, W = 2, $66^2 = 1 = 55^2$.
5. „ „ „ $1_3, 1_3$; m_1, W = 1133, $66^2 = 2$.
6. „ „ „ $1_3, 1_3, 1_3, 1_3$; m_2, W = 2, $66^2 = 1 = 55^2$.
7. Asym. $5_6, 1_3, i3_5$; m_1.
8. „ $3_5, i3_5$; m_3, W = 112.
9. „ „ „ ; m_3, W = 22.
10. „ $i3_5, i3_5$; m_4, W = 13, 76 = 6, 666 = 0.
11. „ „ „ ; m_1, W = 13, 76 = 7, 666 = 0.
12. „ „ „ ; m_4, W = 13, $6 = 75^5$, 76 = 8, 666 = 0.
13. „ „ „ ; m_4, W = 13, 6 ± 75^5, 76 = 8, 666 = 0.
14. „ „ „ ; m_4, W = 13, 666 = 1.
15. „ „ „ ; m_4, W = 112.
16. „ „ „ ; m_4, W = 22, 76 = 7.
17. „ „ „ ; m_4, W = 22, 76 = 6.
18. „ $i3_5, i4_{000}$; m_2, W = 12.
19. „ $i3_5, i4_{00}$; m_2, W = 3.
20. „ $i4_{00}, i4_{00}$; m_4. W = 2, 77 = 1, 666 = 2.
21. „ „ „ ; m_4, W = 2. 77 = 1, 666 = 4.
22. „ „ „ ; m_4, W = 2. 77 = 0, $7 = 6^4 5^3$.
23. „ „ „ ; m_4, W = 2, 77 = 0, $7 \pm 6^4 5^3$.
24. „ „ „ ; m_4, W = 11.
25. „ $2_4, 2_4$, ; m_2, W = 222.
26. „ $1_3, 1_3, 1_3, 2_4$; m_3, W = 1.
27. „ $2_4, i3_5$; m_1, W = 23.
28. „ „ „ ; m_1, W = 14, 666 = 1.
29. „ „ „ ; m_1, W = 14, 666 = 3.
30. „ „ „ ; m_1, W = 14, 666 = 0.
31. „ „ „ ; m_1, W = 113.
32. „ „ „ ; m_1, W = 5.
33. „ $1_3, 1_3$; m_2, W = 26.
34. „ „ „ ; m_2, W = 233, 76 = 5.
35. „ „ „ ; m_2, W = 233, 76 = 7.
†36. „ „ „ ; m_2, W = 8, $E_0 = 2$.

37.	Asym.	$1_3, 1_3, 1_3$;	m_3,	W=23,		666=3.
38.	,,	,, ,, ,, ;	m_3,	W=23,		666=0.
39.	,,	,, ,, ,, ;	m_3,	W=14.		
40.	,,	,, ,, ,, ;	m_3,	W=1112.		
41.	,,	,, ,, ,, ;	m_3,	W=113,		666=0.
42.	,,	,, ,, ,, ;	m_3,	W=113,		666=1.
†43.	,,	$1_3, 2_4$;	m_1,	W=34,		E_0=1.
44.	,,	,, ,, ;	m_1,	W=115.		
45.	,,	,, ,, ;	m_1,	W=25.		
†46.	,,	,, ,, ;	m_1,	C=6, W=1,		E_0=1.
47.	,,	$1_3, 1_3, 2_4$;	m_2,	W=13,		666=2.
48.	,,	,, ,, ,, ;	m_2,	W=13,		666=0.
49.	,,	,, ,, ,, ;	m_2,	W=22,		76=4.
50.	,,	,, ,, ,, ;	m_2,	W=22,		76=5.
51.	,,	,, ,, ,, ;	m_2,	W=112,	$7_0 6_1 6_1 5_0 6_1 6_1$,	666=1.
52.	,,	,, ,, ,, ;	m_2,	W=112,	$6_0 6_1 6_1 5_0 6_1 6_1$,	666=1.
53.	,,	,, ,, ,, ;	m_2,	W=112,	766=0,	666=0.
54.	,,	,, ,, ,, ;	m_2,	W=112,	766=2,	666=0.
55.	,,	$1_3, 2_4, 3_5$;	m_1,	W=2.		
56.	,,	$1_3, 2_4, i3_5$;	m_1,	W=11,		$7_1 6_0 6_1 6_0 6_1 6_0$.
57.	,,	,, ,, ,, ;	m_1,	W=11,		$7_1 5_0 6_1 7_0 6_1 5_0$.
58.	,,	,, ,, ,, ;	m_1,	W=11,		$6_1 6_0 6_1 6_0 6_1 6_0$.
59.	,,	$1_3, 3_5, i3_5$;	m_1,	W=1.		
60.	,,	$1_3, 3_5$;	m_1,	W=33.		
61.	,,	$1_3, i3_5$;	m_1,	W=15,	766=1,	$7_1 5_0 6_1 6_0 6_1 6_0$.
62.	,,	,, ,, ;	m_1,	W=15,	766=1,	$6_1 5_0 6_1 6_0 6_1 6_0$.
63.	,,	,, ,, ;	m_1,	W=15,	766=4.	
64.	,,	,, ,, ;	m_1,	W=15,	766=2.	
65.	,,	,, ,, ;	m_1,	W=114,	666=0,	$5_0 6_2 6_0 6_1 7_1 6_1$.
66.	,,	,, ,, ;	m_1,	W=114,	666=0,	$5_0 6_2 6_0 7_1 6_1 6_1$.
67.	,,	,, ,, ;	m_1,	W=114,	666=0,	$7_0 6_2 5_0 6_1 6_1 6_1$.
68.	,,	,, ,, ;	m_1,	W=114,	666=1.	
69.	,,	,, ,, ;	m_1,	W=123,		$5_0 6_2 6_0 6_1 7_1 6_1$.
70.	,,	,, ,, ;	m_1,	W=123,		$5_0 6_2 7_0 6_1 7_1 6_1$.

71\. Asym. 1_3, $i3_5$; m_1, W=1122, 666=1.

72\. ,, ,, ,, ; m_1, W=1122, 666=0.

73\. ,, ,, ,, ; m_1, W=222, 766=1.

74\. ,, ,, ,, ; m_1, W=222, 766=2.

75\. ,, ,, ,, ; m_1, W=24.

†76. ,, ,, ,, ; m_1, W=6, $E_6=1$.

77\. ,, 1_3, 1_3, 1_3, 1_3 ; m_4, W=11, 666=0.

78\. ,, ,, ,, ,, ,, ; m_4, W=11, 666=1.

79\. ,, 1_3, 1_3, $i3_5$; m_2, W=3.

80\. ,, ,, ,, ,, ; m_2, W=12, 666=0, $7_0 6_2 6_0 7_1 6_1 6_1$, 76=8.

81\. ,, ,, ,, ,, ; m_2, W=12, 666=0, $7_0 6_2 5_0 6_1 7_1 6_1$, 76=8.

82\. ,, ,, ,, ,, ; m_2, W=12, 666=0, 76=7.

83\. ,, ,, ,, ,, ; m_2, W=12, 666=0, 76=6.

84\. ,, ,, ,, ,, ; m_2, W=12, 666=1, 76=5.

85\. ,, ,, ,, ,, ; m_2, W=12, 666=1, 76=6.

86\. ,, ,, ,, ,, ; m_2, W=12, 666=2, $6_0 6_2 6_0 6_1 6_1 7_1$.

87\. ,, ,, ,, ,, ; m_2, W=12, 666=2, $5_0 6_2 6_0 7_1 6_1 6_1$.

88\. ,, ,, ,, ,, ; m_2, W=12, 666=2, $5_0 6_2 6_0 6_1 7_1 7_1$.

89\. ,, ,, ,, ,, ; m_2, W=12, 666=2, $5_0 6_2 7_0 6_1 6_1 7_1$.

90\. ,, ,, ,, ,, ; m_2, W=12, 666=3.

91\. ,, ,, ,, ,, ; m_2, W=111, 76=5.

92\. ,, ,, ,, ,, ; m_2, W=111, 76=3.

Q. $76^{10}5^{18}$.

1\. Moz. 2_4, 2_4, 2_4 ; m_3, W=1, $460^{4}0$.

2\. Asym. 1_3, $i3_5$; m_1, W=122.

3\. ,, ,, ,, ; m_1, W=23, 76=3.

4\. ,, ,, ,, ; m_1, W=23, 76=4.

5\. ,, ,, ,, ; m_1, W=113.

6\. ,, 1_3, 1_3, 1_3, 1_3 ; m_4, W=1.

7\. ,, 1_3, 1_3, 1_3 ; m_3, W=22.

8\. ,, 1_3, 1_3, $i3_5$; m_2, W=11, 76=3.

9\. ,, ,, ,, ,, ; m_2, W=11, 76=4.

10\. ,, ,, ,, ,, ; m_2, W=2.

11.	Asym.	$1_8, 1_8, 2_4$; m_2, W=3.
12.	,,	$1_8, 2_4$; m_1, W=6.
13.	,,	,, ,, ; m_1, W=15.
14.	,,	$2_4, 2_4$; m_2, W=14.
15.	,,	$2_4, i3_8$; m_8, W=112.
16.	,,	$i3_5, i3_5$; m_4, W=12, 666=4.
17.	,,	,, ,, ; m_4, W=12, 666=5.
18.	,,	,, ,, ; m_4, W=12, 666=6.
19.	,,	,, ,, ; m_4, W=111.
20.	,,	$i4_{00}, i4_{00}$; m_4, W=1.

R. $6^{12}5^{12}$.

1. 3-zo. Monch. Hetz. 1_8, 1_8 ; m_1, W=222, 4 zones all $660^8 0^8$.

REMARKS UPON THE THEORY OF HEREDITY.

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My object in this paper is to investigate how far the various cases of Mental Inheritance, brought forward and discussed at a recent meeting of this society, can be accounted for by Mr. Darwin's hypothesis of "Pangenesis," or some modification of it.

Mental inheritance, it seems to me, should not be considered alone, but along with a great number of connected phenomena, including not only physical inheritance, but also all such cases as the development of gemmæ, or buds, into perfect animals or plants, the reproduction of lost limbs and other parts in some organisms, the growth of small pieces of a body into perfect individuals, the various kinds of Parthenogenesis, and the healing of wounds. All of these are cases in which something which went before is reproduced more or less perfectly, always sufficiently to indicate a connection between the two organisations; as, for example, when a Lobster or a Salamander grows a new limb in the place of, and very similar to, one which has been lost; or when a Coral or a strawberry plant develops as a bud a new individual which can scarcely be distinguished from the parent form. It seems probable that all of these are modifications of one process, and ought therefore to be accounted for in the same way. Darwin's "Pangenesis" and Galton's "Theory of Heredity" appear, both of them, to be more or less applicable to all the cases referred to above, and are entitled, I believe, to more serious consideration than seems to have been given to them.*

Let us first examine some of the phenomena to be

* For a discussion of Pangenesis, see Galton's *Hereditary Genius.*—Macmillan, 1869 (p. 363), Ribot's *Heredity.*—King & Co., 1875 (p. 276), and Brooks' *Heredity.*—Murphy & Co., Baltimore, 1883 (p. 48).

accounted for, with the object of finding out what they have in common.

When a simple Protozoon (*e.g. Protamœba*) gives off a piece of protoplasm which develops into a Protozoon like the parent form, there is nothing very remarkable in the almost perfect resemblance, since the young individual was merely a sample of the parent and possessed all its characteristics with the exception of size. When a *Hydra* produces a new individual by gemmation, or when it is artificially divided into several pieces each of which develops into a complete *Hydra*, the region or fragment which possesses this power of reproducing the entire body is composed of a number of cells, and in both cases some of these cells are derived from the ectoderm and some from the endoderm, the two layers of which the body of *Hydra* is formed, so that in this case also the gemma which produces the new individual fairly "represents" the body of the parent. Then in the case of higher forms, such as some worms, where a complete animal can be produced from a part, the body is composed of three layers—the ectoderm, the mesoderm, and the endoderm; and it is necessary for the success of the experiment that the fragment cut off should contain cells belonging to the three layers. In short, it has come to be regarded as a rule of universal application in biology, that when an organism reproduces by gemmation, the gemma must contain representatives of *all* the primary layers of the parent's body.*

* Throughout the various and complicated methods of gemmation occurring amongst the Tunicata, the bud appears invariably to consist of epiblastic, mesoblastic and hypoblastic outgrowths from the parent's body, and these are developed into the ectodermal, mesodermal and endodermal tissues of the adult. The Polyzoa have been regarded as forming a remarkable exception to this rule, but Professor Haddon has recently shown (*Quarterly Journal of Microscopical Science*, 1883, vol. xxiii, p. 516) that probably in this group of animals, as in all others which reproduce by gemmation, representatives of the three primary germinal layers enter into the formation of the bud.

Then again, when a tadpole's tail is cut off and a new one develops in its place, the new tissues—ectodermal mesodermal, and endodermal — are all developed from tissues of the same nature in the creature's body; and the healing of wounds may, I think, be considered as another example of the same process, where, however, the result is not so perfect. In none of these cases have we one cell or one set of cells developed into a different kind of cell, but we always find that the various parts of the new individual or organ are developed, each from a cell or set of cells of its own kind in the parent body. And hence it is very difficult, if not impossible, for a biologist to imagine such an occurrence as an epiblast cell giving rise to a hypoblast tissue, or a bud composed of mesoblast alone developing into an animal with organs which are usually derived from epiblast and hypoblast.

When, however, we come to Gamogenesis, or sexual reproduction, we have what is apparently a single cell, the fertilised ovum, formed by the fusion of two cells—the male and female elements—developing into the entire body. But we have seen that in cases of gemmation there is reason for believing that the gemma invariably contains representatives of all the layers of the parent body; and I see no reason why we should not believe the same of the ovum, which is sometimes as large as a gemma. It may be objected that the ovum is unicellular, while the gemma is always composed of more than one cell; but in some gemmæ there are very few cells indeed, and we know of interesting and instructive cases, which may be regarded as transitional between multicellular gemmæ and unicellular ova, in the shape of the winter eggs of some Sponges and the statoblasts of some Polyzoa, these being cases of peculiar gemmæ in which a number of originally distinct cells become closely united during a dormant period previous to development. It is conceivable, and

I think not improbable, when viewed in the light of the facts just stated, that the fertilised ovum, though apparently unicellular, may be really very complex in structure, and may contain representatives of all parts of the parent's body, and when this is admitted, the main difficulty in granting the assumptions necessary for Pangenesis has been got over.

Darwin's "Provisional Hypothesis of Pangenesis," as he modestly calls it in his *Variation of Animals and Plants under Domestication* (vol. ii, p. 357), is briefly as follows:— "Every cell of the animal's body, so long as it is not too highly differentiated, throws off gemmules which are capable of multiplying by fission, and which retain the characteristics of the cells from which they arose, and are capable of reproducing them at some future period by developing into similar cells. These gemmules are transmitted to the offspring by means of the reproductive elements, and may remain dormant in the new individual for a time, or even through a number of generations. When they finally develop into cells, it is as a result of their affinity for allied gemmules produced before them, and which have just attained their full development." In his work on *Variations under Domestication* (1868), and also in the *Descent of Man* (1882), Darwin makes use of Pangenesis in explaining the most diverse instances of heredity, and points out that the hypothetical dormant condition of the gemmules accounts for the facts of atavism, while the inheritance of characters at corresponding periods of life in the parent and the offspring is the natural result of the assumption that the development of the gemmules depends on their affinity for other gemmules previously developed.

A few years previous to Darwin's enunciation of Pangenesis, Herbert Spencer, in his *Principles of Biology* (vol. i, chap. 8, 1864), in discussing heredity, assumes the existence of "physiological units," which are not cells but which

appear like Darwin's gemmules to be derived from cells, to have the power of afterwards developing into similar cells, and to be stored up in great numbers in the productive elements, which thus contain representatives of the whole parent body. This suggestion of Mr. Spencer's in its essential features seems very similar to Pangenesis but is less completely worked out, and hence it need not be considered separately.

In 1876, Mr. Francis Galton, F.R.S., read before the Anthropological Institute, *A Theory of Heredity* (see *Journal of the Anthropological Institute*, vol. v, p. 329), which is essentially a modification of Pangenesis. He calls the sum total of gemmules contained in the fertilised ovum, "stirp," a very convenient term; and considers that not all the gemmules in the stirp achieve development during that generation, but only a few, which may be regarded as comprising the dominant gemmules of each "segmentation" or division, of which there are assumed to be a number in the stirp. The rest of the gemmules remain latent, and, according to Galton, multiply by fission, and are passed on in the reproductive elements or buds to the next generation. According to this theory, it is obvious that the cells of the body of the offspring are not formed by the development of gemmules arising from the cells of the body of the parent, but by the development of gemmules from the stirp of the parent; hence the offspring, both stirp and body, is connected with the stirps of preceding generations and not with the bodies. This is an important difference between Galton's theory and Pangenesis.

The apparent inheritance of characters acquired for the first time in a parent is not accounted for by this theory of the relationship between stirps only; but Galton argues that the appearance of such characters in the offspring may not be a true case of inheritance, as it is possible, if not probable, that the conditions which gave rise to the acquired character

in the parent may have affected, not merely the cells of the region where that character appeared, but also undifferentiated cells over the whole body, and especially those of the reproductive elements. Hence the residual gemmules, which form that parent's part of the stirp of the offspring, would have impressed upon them a modification corresponding to the character acquired by the parent, and consequently that character might make its appearance either in the immediate offspring or in some future generation.

Let us now examine the assumptions upon which these two theories, Darwin's and Galton's, are based. The first is that cells give off small particles called gemmules, which are too small to be visible with the highest powers of the microscope, but which have the power of reproducing the whole cell. Now, I see no objection to this from a biological point of view. We are familiar amongst the lowest organisms with cases of cells (*e.g. Torula*) which give off minute portions of their protoplasm in the form of buds which develop into organisms exactly like their parents. These give off similar minute buds, and so the process goes on, generation after generation. Hence I have no difficulty whatever in admitting that it is possible, or even probable, that undifferentiated cells have the power of throwing off gemmules such as those made use of by Darwin and Galton.

The next assumption is that these gemmules have the power of reproducing by fission, and I think no biologist who grants the possibility of their existence will deny them this power. Fission is the simplest method of reproduction we know of, and is performed by the majority of lowly developed organisms. In fact, in many of the simplest forms it seems to be the natural result of abundant nutrition. *Protamœba* feeds, increases in size, and then divides by simple fission into two individuals. It is difficult to imagine living gemmules formed of simple protoplasm existing in a healthy

body without being nourished; and hence the reproduction of gemmules might almost be removed from the list of assumptions, and considered as a necessary consequence of the existence of the gemmules.

One of the assumptions of Pangenesis is, that the gemmules circulate freely throughout the body. This power is not necessary for Galton's theory, where the cells of the parent's body do not affect or help to form the stirp of the offspring, but there can be no difficulty in granting the possibility of this power of locomotion. We know of several different modes of locomotion which are found in unicellular animals and plants of the simplest structure, and amongst the undifferentiated cells in the bodies of higher animals. We see small pieces of protoplasm given off as buds from the body of a *Protamœba*, moving by amœboid motion, and giving off in their turn small portions which also have the power of locomotion; and it would be quite natural, and according to the principle of continuity, to suppose that if much smaller particles, the gemmules, were given off, these also would possess the power of amœboid motion.

So far I have no difficulty in accepting either Pangenesis or Galton's theory. The two or three assumptions are not only quite possible, but even, I think, probable from a biological point of view; but when we pass on to the development of a new body or organ from the gemmules of the stirp, I find it difficult to imagine the process, on account of a practical—it might almost be called an histological—objection, which seems to apply to both theories. Darwin imagined, if I understand the description of Pangenesis rightly, that the gemmules lie in many if not most cases *between* the cells of the bud, embryo or body, and in that position, and as the result of the development of other related gemmules, develop into new cells. Now of course we cannot expect to see the gemmules themselves lying between cells; but as the cells

are clearly visible under moderate powers of the microscope, I think it is not too much to expect that we should see some traces of the later stages at least of the development of gemmules into new cells. But, so far as I am aware, there is no evidence that such a process ever takes place.

Galton seems to suppose that in the early stages of the development of the ovum, the gemmules, by separating into groups according to their affinities, cause the phenomena familiarly known as "segmentation," but if I understand him rightly, he allows, at later stages of development or in the adult body, the gemmules to wander from cell to cell, or to become intercellular in position and then develop into new cells, and consequently his theory seems open to the same histological objection which I have urged against Pangenesis. In the most careful and trustworthy observations which have been made upon the development of animals or organs it has, I believe, been invariably found that no cells originate except by the reproduction of preexisting cells. Hence I would suggest, as a modification of Pangenesis or of Mr. Galton's theory, *that the body of the new individual is formed, not by the development of gemmules alone and independently into cells, but by the gemmules in the cells causing by their affinities and repulsions these cells so to divide and re-divide as to give rise to new cells, tissues and organs.*

Commencing with the fertilised ovum, we have a single cell containing all the gemmules of the stirp along with more or less food material. These gemmules then separate into two masses, thus causing the first segmentation furrow. In each mass further internal separation of gemmules takes place, causing further superficial segmentation; and so the process goes on, till at the close of segmentation we have a young embryo formed of a number of

blastomeres or embryonic cells, each containing a mass of gemmules, differing in certain characters from the gemmules in the other blastomeres, and destined to give rise to a particular region or organ of the future body. It is natural to suppose that this process would continue unchanged during the life of the individual, and that when a blastomere has developed into hundreds or thousands of cells, each of these cells would, if not too much differentiated, contain some of the gemmules of the original blastomere or their descendants, and consequently would still be liable to be "drawn asunder" into two cells by the activity of the contained gemmules. A number of recent careful researches into cell division have shown that that process is in most cases preceded by a series of remarkable changes, which have been minutely described in many different kinds of cells under the name of "karyokinesis."* These changes take place in the nucleus, and seem to indicate that division is the result of a very considerable amount of activity in that, the central, region of the cell. This appears to me distinctly in favour of my suggestion, that the division of cells is the result of the activity of the gemmules derived from the stirp, and that these gemmules develop into cells only in the sense of causing pre-existing cells to divide, and by influencing these cells in such a way as to modify them into cells similar to those from which the gemmules were originally derived.

With this modification, it seems to me that Pangenesis—or, better still—Galton's theory does not require any improbable assumptions, is not opposed to any fact or principle of Biology, and if it is found sufficient to account for all observed phenomena of inheritance, mental and physical, gemmation, reproduction of lost limbs, healing of wounds, etc., should be accepted as the theory of Heredity.

* See Cunningham, *Quarterly Journal of Microscopical Science*, 1882 (vol. xxii, p. 35).

I shall now briefly indicate how this theory can be made to account for the various cases of inheritance or non-inheritance brought forward at the last meeting of this society. First, a case of ordinary inheritance, where the offspring combines the character of both parents, may be explained as follows:—Two stirps (*i.e.* the father's and the son's) which have a common origin will naturally contain similar gemmules, and when the dominant gemmules of these stirps develop they will naturally give rise to similar bodies. But the stirp of the son is formed partly from the stirp of the father and partly from the stirp of the mother, and hence will combine their characters. Consequently when there is no complication the offspring will exhibit a combination of the characters of the parents.

Then a case where the offspring resembles one parent only may be explained as an instance in which, in the stirp of the son, the gemmules derived from the paternal and maternal stirps were to a greater or less extent antagonistic—for it is probable that gemmules, like all organisms and cells, are subjected to a struggle for existence—and where in the struggle the paternal gemmules, let us say, were dominant—the result being that the son would resemble the father only.

A case of atavism, where the offspring resembled neither parent, but exhibited the characteristics of an ancestor perhaps several generations back, might be due to either of two causes, or possibly to a combination of them. Let us suppose a boy resembles one of his great-grandfathers more than any of his more immediate ancestors. Such a case might be due—(1), to certain of the paternal and maternal gemmules in his stirp being antagonistic and neutralising each other so as to allow some other gemmules descended from the great-grandfather's stirp to become dominant; or (2), to the great-grandfather having possessed some character so unusually developed that the corresponding gem-

mules in his stirp became exhausted, and were unable to reproduce that character in the stirps of the grandfather and of the father, but had become so dominant in the stirp of the son, on account of the prolonged period of repose during which they had been merely multiplying and remaining dormant, that they were able to mask to a large extent the action of the paternal and maternal gemmules, and so reproduce the characteristics of the great-grandfather.

Where the characters of a race or a nation have become so pronounced and persistent as almost to defy extinction, as in the case of the Jews, it may be that these characters originated (*i.e.* were first strongly marked) in an ancestor in whose case the corresponding gemmules of the stirp did not become exhausted, and where consequently the stirps of the offspring would possess these gemmules (or their descendants) in a dominant condition. Then heredity may have been aided by natural selection and marrying within the tribe, so as to cause what may be spoken of as a saturation of the gemmules of the race with these peculiar characters on account of those individuals surviving in which these characters were best marked; the result of which would be that changed conditions and intermarriage with members of other races which had not such pronounced and persistent characters would for long have little apparent effect.

The interesting case of supposed non-inheritance, where the offspring of two deaf mutes could hear and speak,* may be explained as an instance of atavism, where the peculiar configuration or deficiency of gemmules in the stirps of the parents which caused their deaf-mute condition was overcome or made good in the stirp of the offspring by more ancestral gemmules which had been few in number and dormant in the parental stirps. In such a case as this, if the normal offspring married a deaf-mute it would be natural to suppose that

* See Ribot's *Heredity* (p. 42).

the ancestral deaf-mute condition might re-appear in their offspring.

Those cases of peculiar mental characteristics which there is good reason to believe appear for one or two generations and then die out* may, I think, be explained in much the same way. A peculiar mental condition—some form of great genius, for example—is, I suppose all will admit, accompanied by some peculiar configuration of nerve-cells in the brain, and that is the result—neglecting training, which I shall discuss presently—of a peculiar configuration of gemmules in the stirp. Hence such an individual (A), if the peculiar development of his nerve-cells has not exhausted all the corresponding gemmules, and that no doubt happens in many cases, will hand down to his offspring a tendency towards the same mental condition which will appear in this generation (B), if not diluted or masked by maternal gemmules in the stirp. In the next generation (C), these peculiar gemmules will be still more liable to be masked, as they have been now diluted by gemmules from the stirps of both mother and grandmother; and besides, atavism may now come in so as to obliterate the peculiar configuration of gemmules by causing reversion to the normal characters of the ancestors previous to (A), who was, of course, an abnormal and quite exceptional individual. From this there is very little chance of (C) having his grandfather's genius, and there is still less chance of its being handed down to the next generation (D).

Even a case of sudden mental conversion, of a man acquiring certain mental peculiarities late in life, which might be thought inexplicable by heredity, need not, I think, present any difficulty. The mental condition acquired was, of course, the consequence of a peculiar configuration of nerve-cells in the brain, and previous to the attainment of

* See Ribot's *Heredity* (p. 301).

this peculiar configuration that mental condition could not arise; hence the mental condition may be explained (neglecting training) simply as the result of the development of nerve-cells caused by the activity of the gemmules of the stirp.

The interesting case, in which a large proportion of a certain number of children from amongst the most wretched and apparently most degraded of our population turned out well when placed under totally changed conditions of existence, has been brought forward to show, I suppose, the great effect of training or external conditions in neutralising or totally obliterating inherited characteristics; but it may, I think, be explained in another way. The stirps of these children were by our hypothesis derived from the stirps of their parents, and the component gemmules were consequently very little affected by the external conditions in which the parents were placed; and their tendency would naturally be, when placed under new conditions, to develop into people similar to what the fathers and mothers would have been under these new conditions, and not similar to what the fathers and mothers were under the old conditions. And besides, atavism would no doubt act in some cases. Here, of course, statistics are required; but it is very possible that many of the children had comparatively near ancestors in a better condition of life, and contained gemmules in their stirps in a dormant but multiplying condition, which were derived from the stirps of their ancestors, and might at any time cause a reversion to ancestral characteristics.

It is scarcely necessary to point out the application of my theory to such cases as the transmission of characters by gemmation, and the reproduction of lost limbs. If a *Hydra* bud composed of ectoderm and endoderm cells becomes a *Hydra* like the individual from which it grew, it must be because its ectoderm cells contain gemmules of the same kind as those in the ectoderm cells of the parent, and which

will consequently, when they become active, cause the cells in which they lie so to divide and grow as to form an ectoderm with the proper characters: and similarly for the endoderm. In the same way, an Ascidian gemma develops into an organism like its parent, because its young ectoderm, mesoderm and endoderm cells contain gemmules of the same kind as those which formed the corresponding layers in the parent, and it is only natural to suppose that similar gemmules will mould their enclosing cells into similar tissues and organs.

In two of the cases discussed above I have neglected training, education, or nurture, as being of comparatively little importance, as is shown by the results of Mr. Galton's researches on this subject. For the statement of his experience I would refer you to his interesting paper "On the history of Twins as a criterion of the Relative Powers of Nature and Nurture" (*Journ. Anthrop. Instit.*, vol. v, p. 391, 1876), where you will find that he comes to the conclusion that, omitting exceptional cases of nurture and considering ordinary cases only, nurture goes for very little and may be almost ignored.* He gives the following striking instance of the failure of nurture to effect anything in the case of one of the lower animals: "Consider the history of the cuckoo, which is reared exclusively by foster-mothers. It is probable that nearly every young cuckoo during a series of many hundred generations has been brought up in a family whose language is a chirp and a twitter. But the cuckoo cannot or will not adopt that language, or any other of the habits of its foster-parents. It leaves its birth-place as soon as it is able, and finds out its own kith and kin and identifies itself henceforth with them. So completely is its change of

* See also:—*English Men of Science: their Nature and Nurture.*—Macmillan, 1874 (p. 12), and *Inquiries into Human Faculty and its Development.*—Macmillan, 1883 (p. 382).

life carried out, and so utterly are its earliest instructions in an alien bird-language neglected, that the note of the cuckoo tribe is singularly correct. Dr. Romanes tells us that he has compared the cuckoo's note with a tuning-fork at home and abroad, and has found it to be identically the same in both cases" (p. 405).

The influence of education or training upon the mind is merely a part of the great question of the influence of surrounding conditions upon organisms, and there is no doubt that in certain cases nurture or surroundings appear to have a marked effect upon the physical or mental condition; but as Darwin has pointed out (*Origin of Species*, 6th edition, p. 106), the nature of the organism—which is, of course, dependent upon the gemmules derived from its ancestors—is much more important than the nature of the conditions in determining variations. I would go even further, and say that, according to my modification of the theory of heredity, external conditions can only act upon organisms by allowing or repressing the development of what is already present in the form of gemmules derived from ancestors. And even this, which might seem superficially to be an effect produced by surroundings, it must be remembered, is only a modification of the *individual*, not of the *species* or *race*. For since, by our hypothesis, the stirp of the offspring is connected not with the *body* of the parent but with the *stirp*, it results that a change produced upon the parent as an individual affects only the dominant gemmules of his stirp which are active in that generation, and need not modify, and certainly cannot directly * modify, the dormant gemmules, some of

* The dormant gemmules may, as Galton has pointed out, be indirectly modified by the action of very severe external conditions which affect the tissues of the body generally. For example, dissipation in the parent may produce a recognisable effect in the offspring. This, however, is not a case of inheritance; the effect was produced upon the gemmules of the stirp of the offspring while they were still in the body of the parent.

which will help to form the stirp of the offspring. Hence the modification of the parent, due to an activity of gemmules which was permitted by the external conditions, would not be inherited, but it might, of course, be developed in the offspring independently, just as it was developed in the parent. The necessary gemmules would be inherited, and if the conditions remained the same, doubtless the parental modification would reappear; but it could not, I hold, even in this case, be regarded as an inherited modification, caused by external conditions. If this peculiar modification was in any way advantageous to its possessors, the action of natural selection * would cause it to be seized upon and fixed as a character of the race or species which would then probably be inherited. For after a few generations in which the modification had been independently developed in each individual (any in which it did not appear or in which it was feebly exhibited would be eliminated by natural selection), the race of gemmules upon the development of which the modification depended would doubtless become impressed with the character of becoming active in the proper sequence and manner so as to produce the required modification in every generation. † In this way, and in this way only, I imagine, a newly acquired modification may, if so useful as to be seized upon by natural selection, come to take its place among the ancestral characters which are normally handed down from generation to generation by the action of heredity.

* As Darwin has shown (*Origin of Species*, 6th edition, p. 107), the constant action of natural selection is liable to be mistaken for an effect produced by external conditions.

† For another view as to variation, see Dr. W. K. Brooks' work on *Heredity*, which has reached my hands just as this paper is going to press.

THE MODIFICATION OF HEREDITARY TRANSMISSION, BY MENTAL AND EDUCATIONAL INFLUENCES.

By JOHN W. HAYWARD, M.D.

It is a fact that mental peculiarities and powers are transmitted to offspring; and that some offspring resemble, in these respects, more the male and others more the female parent.

Professor Herdman, in a very learned and profound paper, read before this Society,* gave us reasons for this fact—scientific and physiological reasons—showing us in what the fact has its origin. He led us up to its source, at the beginning of each individual, in the fertilised microscopic ovule, called by Francis Galton the "stirp," or in the hypothetical ultra-microscopic particles called the gemmules—the gemmules having the characteristics of the parent from which they sprang and conveying the same to the offspring to whose development they contribute. He taught us that it is the stirp growing into individuals resembling the parents that contributed to its formation, modified by the supposed gemmules, that is the cause of hereditary transmission: the offspring resembling more the parent that supplied the stronger, more numerous, or more active gemmules. He indeed went further, and accounted in the same way for the recurrence of ancestral peculiarities; it was, he said, by the recovery of activity by previously dormant ancestral gemmules, which had found their way into the stirp of the offspring; and he went further still, and

* Page 77.

accounted for variations and any improvement that might occur in offspring, by "the survival of the fittest" amongst the gemmules, which have to struggle for existence in accordance with the doctrine of natural selection.

Had Professor Herdman ended here, and not added the paragraph which concluded his paper, there would have been nothing with which I could not thoroughly agree. Indeed I thought then, and I still think, that a more apparently true, clear, definite and satisfactory explanation could scarcely have been given, so far at least as the merely physical phenomena of hereditary transmission are concerned; for it is undoubtedly true that as the tree is by nature, so by nature will the future seed be, and as the seed is so will the future tree be, or at least with very slight variation. That is, this is so in nature unmodified by human interference. When, however, Professor Herdman went on to question and to deny the effect and the permanency of the effects of training, education and nurture, I felt I could not go along with him; for to my mind it is equally true that a mannerless rustic of the past may have been the progenitor of a beau of the present generation, and a moralist of this generation may be succeeded by a profligate in the next, the reason of which we need not seek in the assumed recovery of activity by previously dormant ancestral gemmules, but in the influence of the education, training and surroundings which have been brought to bear on the individual in question, as numberless instances might be adduced to show, were it necessary. Indeed, our laws and our whole social system are based upon this conviction; the conviction itself being the common consent of mankind resulting from the experience of ages, so as to form the very *raison d'être* of our scholastic and educational institutions and efforts. When, after having traced hereditary transmission to the matter of the ovum and spermatozoon and the vital activities resulting from their union in the fertilised germ,

and referring to cases illustrative of the opinion he had advanced, Professor Herdman deliberately went on to say:—"In two of the cases discussed above I have neglected training, education, and nurture as being of comparatively little importance," and then to conclude with the following words:—"Of course, it must be admitted that there are exceptional cases of nurture or surroundings which appear to have a marked effect upon the physical and mental condition; but such effects, according to the present theory, need not modify, and certainly cannot directly modify, the gemmules of the stirp, and therefore would probably not be inherited,"—I say, when Professor Herdman thus summed up his remarks, I could not but feel that his language would tend to produce on the minds of many of the members of this society the impression that the human race was under the domination of blind fate and merely physical laws, and that as it had been created so it was to remain, except so far as it might be modified during the course of ages under the influence of the laws of evolution and natural selection. Such an impression was, to my mind, not justified by the facts of the case, nor was it desirable it should remain upon us who are responsible human beings, especially when induced by such an authority as Professor Herdman. I therefore the next day wrote to our secretary for permission to lay before you a few thoughts on "The Modification of Hereditary Transmission by Educational and Mental Influences."

Notwithstanding the unqualified, unhesitating, and apparently authoritative manner in which the merely physical transmission theory was laid before us, I cannot bring myself to believe that Professor Herdman intended to produce or leave upon us the impression that as the human race was created so it is to remain, except so far as it may be modified under the influence of the laws of evolution and natural selection, altogether uncontrolled and uncon-

trollable by mental and moral agencies. Yet that such an impression was produced, was evidenced by the remarks of Dr. Carter and Dr. Shearer; both of them complained of it, and both spoke at some length in support of the modifying and improving effects of training, education and religion. Had it not been thus evident that the impression was produced, I would not trouble you with any remarks on this matter, even though man's subjection to merely physical laws has been taught by other naturalists besides Professor Herdman; for I am afraid that it will appear to many of you, as it does to myself, that I am reviving the old and well-discussed question of "Art *versus* Nature in the Formation of Character," or am attempting to prove that which is really self-evident and all but universally accepted as true. Nevertheless, the subject ought not to be left, in this society, where Professor Herdman has placed it, even though he is supported by many other naturalists of great distinction.

I have myself always thought it was unjust to Darwin to impute to him the teaching of such an opinion. Francis Galton has, however, I fear, justly laid himself open to the charge, when on the opening page of the introductory chapter in his "Hereditary Genius" he says:—"I purpose to show in this book that a man's natural abilities are derived by inheritance, under exactly the same limitations as are the form and physical features of the whole organic world. Consequently, as it is easy . . . . to obtain by careful selection a permanent breed of dogs or horses gifted by peculiar powers of running, or doing anything else, so it would be quite practicable to produce a highly gifted race of men by judicious marriages through several consecutive generations." There is here, it will be observed, no reference to anything but physical causes and material means—judicious marriages, the judicious mixing and transmission of the germ-

cell and sperm-cell materials; as if man were a merely material being without any mental part whatever! And this is the less excusable in Galton because the subject of his book is "mental," not "physical," heredity, as his title is "Hereditary Genius," or mental power. It is true, certainly, that mental power is connected with material structure and bears a strict relationship to it, and that without material structure there is, in this world at least, no mental manifestation whatever; that, in fact, there is and must be a material basis of mind as there is a material basis of muscular power, of sight, of hearing, and of every other function man performs, and indeed of life itself. And it is true also that the material basis of mind is subject to the same laws of origin, nutrition, growth and hereditary transmission as is any other material part of the animal organism. All this is quite true.

Now in the scheme of creation nature rises from the general to the particular, from the simple to the complex. In the animal world she rises from a general mass subservient to all functions to parts differentiated to special uses. In the lowest forms of animal life the whole body appears to be one organ, or rather, all the functions appear to be subserved by one mass. But as we rise in the scale of creation we find nature differentiating parts to the performance of special functions, gradually more and more so up to the most perfect specimens of the animal kingdom—the Mammalia, where apparently every function has its own organ. In the higher animals and in man the body is made up of an assemblage of organs, each to perform certain special work in the animal economy; and according to the size, activity and power of the different organs, so is the performance of the functions of the organs more or less predominant, and so is the character or temperament of the individual—bony, muscular, nervous, mental. When an animal has to

perform certain special work, certain organs are made proportionately large and active for the purpose; and on the other hand, when certain organs are proportionately large and active the animal or individual naturally performs the special functions corresponding with these organs; that is to say, all the organs acting, the larger and more active ones give the trait to the character of the individual.

Now, the material basis of the mind, in the higher animals at least, is the nervous system. Where there is no nervous system there are, at least none of the higher manifestations; but wherever there is a nervous system, and in proportion to its development, there mental phenomena are manifested. It is not only in that part of the nervous system which we call brain, but the whole nervous system. In a general view of the animal creation, the brain, as Dr. Bastian has well put it, is not *the*, but *an*, organ of the mind. In some of the lower forms of animal life the nervous system is very simple, and one simple nervous system subserves all the nervous functions, and the mental as well. But as we rise in the scale of creation we find that nature has differentiated different parts of the nervous system to different uses, placing parts that subserve certain functions, as it were apart for that purpose; separating, for instance, the nerve cells that subserve nutrition from those that subserve sensation, and these again from those that subserve motion, and collecting the cells that subserve mental functions into that mass which we call the brain; and in proportion as the brain is developed so is the performance of mental function relegated to it, the rest of the nervous system being relieved of mental function and left to those of nutrition, sensation and motion. Nor does nature's differentiation of the nervous system stop here, for not only does she collect the cells that subserve mental functions as a whole into the brain as a whole, but she collects the cells that subserve the different manifestations of

mind into different parts of the brain:—those that subserve the lower functions of the mind—the instincts—into the lower and back parts of the brain: those that subserve the higher functions—the moral faculties—into the upper part; and those that subserve the functions of acquiring and using knowledge—the intellectual faculties—into the front part of the brain, and so on; to each faculty of the mind its own material organ, as she does to every other function man performs; every one has its own proper material organ. Man performs no function whatever except through or by means of a material organ.

Now, the material organs of the mental faculties, like those of every other function man performs, are made up of anatomical units called cells; these are minute particles of living matter—protoplasm or bioplasm—transparent, structureless and semifluid, like microscopic globules of mucus. These lie imbedded in another semifluid matter that has exuded from the capillary blood vessels, and which supplies them with nourishment. By a long series of elaborations food is made into blood, and this is carried to every part of the body by the blood vessels, the most minute of which—the capillaries—ramify everywhere amongst the cells of the tissues, and pour out there the more fluid part of the blood—the blood plasma or *liquor sanguinis.* The cells are alive, and by reason of the life that is within them they live and grow at the expense of the pabulum in which they lie. They take up this pabulum into their interior: each set of cells selecting the particles they require—the bone-cells the materials for bone, the muscle-cells the materials for muscle, the brain-cells the materials for brain, and so on; and here, in the interior of the cell, its particles or atoms are drawn into the vortex of vital activity going on within the cell; and here this matter is impressed with the vital motion and character peculiar to the cell by which it is appropriated—

bone-cells making it into bone, muscle-cells into muscle, brain-cells into brain, and so on; that is, this motion and character are impressed upon this new material whilst it is being developed, by means of the vital motion, from ultimate atoms to ultra-microscopic particles. How incalculably infinitesimal, then, are the materials with which nature here works, and how fine the motion—atoms in motion! How sensitive, therefore, to disturbing influences—susceptible to electrical, nervous and even mental influences! When the atoms have been joined into infinitesimal particles, these are made into larger and more complex ones, and these again into still larger and more complex ones, through perhaps many hundreds if not thousands of times of increment of size of material and complexity of motion, up to those of the nucleolus and nucleus of the full-formed cell. When the nucleus is sufficiently grown it becomes a new cell, and the old one disappears; this new cell then carries on the function and lives and grows in the same way, and in its turn leaves one or more successor to take its place. And this goes on continually whilst the life of the organ lasts. Should, however, the vortex of vital activities slacken or fail from any cause whatever, the growth and multiplication of the cells slackens or fails, and the organ tends to decrease in size and power; and should the functional activities be increased by any cause, the growth and multiplication of the cells increases, and the organs grow larger and more powerful.

Now one of the cardinal points in Darwin's great discoveries is, that disuse of an organ causes its decay, and so its non-transmission by inheritance; whilst, within certain limits, increased use increases and develops the organ used, and that this increase and development are transmissible by inheritance. And Darwin has shown, also, that this law has universal operation throughout the organic world.

It is operative in vegetal and animal worlds alike, amongst the lower animals and in man, and it operates alike in man's physical and mental organism—in the material organs of his mind as well as in the material organs of his muscular power; in all his material organs alike. The cause of increase and development by use is, that use being the proper stimulus to the action of the cells of which the organs are made up, it increases the rapidity of the appropriation of the food supplied to the cells by the blood, and thus causes them to multiply more rapidly; and the cells being thus made more active and numerous, the organs are made larger and more powerful. Disuse has, of course, the opposite effect. And the cause of the transmission to offspring of this enlargement and increased activity of the organs is, that the motion and material of the germ-cell and sperm-cell are proportional representatives of those of the parental organisms at the time when the germ-cell and sperm-cell were formed. As before said—as the tree is, so will the future seed be, and as the seed is, so will the future tree be; or, as the parents are, so will the future stirp be, and as the stirp is, so will the future offspring be.

It is the activity of the vital motion going on within the cell that causes the growth and multiplication of the cells of the organ; it is the number of cells that makes the size of the organ, and it is their activity that produces the power. The activity of the cells results from two factors—(1) the primary impetus, and (2) the continuous stimuli. The primary atoms of matter are supposed to be always in motion; this motion must necessarily be modified by the union of two or more atoms, and again by every added hetorogeneous atom. The molecules of the germ-cell and sperm-cell have their own special vital motions. These are so altered by their union in the fertilised germ as to cause segmentation, and to impart to the stirp a *sui generis* motion.

This vital motion, thus set up in the stirp, this "primary impetus," is the special vital activity or power of the ensuing individual, and gives the character—languid or vigorous, short-lived or prolonged, recuperative or otherwise—to the vital activities, that is, the *life*, of the different organs of his body. These activities, of the cells are kept up in each organ by means of their own special and appropriate stimuli. The proper stimuli to the organs of the mental faculties are mental and educational influences. Educational and mental influences can, therefore, increase the size of the material organs of the mental faculties, and consequently cause a predominence of certain mental faculties in the character of an individual. Indeed, speaking physiologically, it is possible by influences brought to bear during the generation and growth of the cells, not only to increase the size of an organ but to absolutely alter its structure, and not only in the present existing organ, but also in the germ of the future being, the cells being by these influences caused to appropriate different material and to elaborate it differently.

If then it is true, as the foregoing considerations show that it can be, and as Darwin has shown it is, that disuse of an organ causes its decay and non-transmission by inheritance, and that increased use causes increase and development, it must follow, as surely as night follows day, that disuse of certain mental faculties will tend to diminish the size and power of their material organs, and that increased use of certain mental faculties will tend to increase the size and power of their material organs; and so the mental character of the individual will be altered. And if it be true that this diminution and increase are transmissible by inheritance, as Darwin has shown they are, it must follow in like manner that diminished or increased size or power of the material organs of the mental faculties is transmissible to offspring, and therefore that training and education must tend to

improve the mental condition of the human race, and not only of the present but of future generations; and consequently that, contrary to Professor Herdman, training, education and nurture do modify, and that directly, the gemmules of the stirp, and that this modification is transmitted by inheritance.

It follows then also, from what has been advanced, that it is possible to improve the human race intellectually and morally by means other than Francis Galton's judicious marriages; that is, by keeping active the higher and leaving dormant the lower faculties of the mind; in other words, by judicious mental training and education. That, in fact, it is quite as possible to improve man mentally by judicious mental training as it is to improve him physically by judicious physical training. True it is, indeed, that this mental improvement is very slow and difficult, and requires reiterated and prolonged efforts; but what great and good achievement does not? Even the physical improvement of mankind is one of the most difficult problems in nature; how much more so the mental? The physical improvement of man is much more difficult than is that of any other member of the animal kingdom, such as the dog or horse; these latter creatures are somewhat under man's control in this matter, whilst man himself is not. Francis Galton says:—"As it is easy to obtain, by careful selection, a permanent breed of dogs or horses gifted by peculiar powers of running, or doing anything else, so it would be quite practicable to produce a highly gifted race of men by judicious marriages." To my mind the two cases are not at all parallel. It does not at all necessarily follow that as the one is, so is the other—that as it is easy to do with dogs and horses, so it is practicable to do with men and women. Dogs and horses do not themselves make or carry out the arrangements that produce the breeds Galton refers to; these are imposed on them by man, who

is their superior. Neither will man make or carry out such arrangements for himself. As with the inferior animals, so with man; if these arrangements are to be carried out it must be by his superior, not by himself; man will never do this for himself. Galton says; "It would be quite practicable by judicious marriages." But who is to arrange these "judicious" marriages? Man himself never will. I think Galton should have made use of the word "possible" instead of "practicable"; I doubt its being practicable. I am ready to admit the possibility, but I doubt the practicability; and I think Galton should have said, "It would be possible were it practicable." Indeed I doubt if it is at all practicable, or even possible, to bring about judicious marriages to any appreciable extent by any means whatever; that is, judicious in the sense Galton here means. Men, and women also, are much too selfwilled and selfish in this matter to marry principally for the improvement of the race. Marriage has been, is, and I fear always will be, too much a matter of mere chance to be made available for improving the race either mentally or physically. Nor would such improvement, if it were practicable, be rapid; for it could only be effective at the beginning of each generation, and by small and uncertain increments, under the law of natural selection. On the other hand, educational and social training and mental and moral influences may be made use of to a very large and increasing, if not an unlimited extent; and that continuously and by ever-growing increments, not only at the beginning but during the whole time of each generation. These are, therefore, the most potent of the means for improving the human race. Blair said :—

"From Education, as the leading cause
The public character its colour draws:
Thence the prevailing Manners take their cast—
Extravagant or sober, loose or chaste."

THE EARLY LIFE OF HEINRICH HEINE.

By R. McLINTOCK.

About a hundred years ago, there lived in Hanover a Jewish tradesman named Heymann Heine, not over-blessed with worldly goods, but blessed with two daughters and six sons. Most of these are of no importance in history; but one of the sons, Solomon Heine, was turned out at seventeen years of age to seek his fortune, and he found it, for he died in 1844 possessed of property counted by millions. His name is still remembered in Hamburg as the founder of the Jewish hospital. His brother Samson achieved no eminence himself, but lived to hear his son proclaimed one of Germany's greatest poets, not unworthy to be named in the same breath as the Olympian Goethe himself.

Harry Heine, the subject of this paper, was the eldest son of Samson Heine and Betty van Geldern, and was born December 13th, 1799, at Düsseldorf, where his parents had opened a shop for the sale of drapery and manufactured goods. Madame Heine's name, *van* Geldern, has misled some writers into supposing that she was a Christian lady of good birth, but in reality it only indicated that her family had at some previous date migrated from Guelders, in the Netherlands. Samson Heine and his wife, in addition to their son Harry, had a daughter born in 1805, and two sons, Gustav born in 1806, and Maximilian born in 1807. Samson died in 1828, and Betty in 1859.

About the first nine years of Harry Heine's life there is naturally very little to tell. In his tenth year he was sent to the Lycée, the principal school in Düsseldorf, governed

at that time by Rector Schallmeyer, a Catholic priest. The under-masters were also for the most part clerics and French. The course of instruction comprised Greek, Latin, German, mathematics and French.

As in the Grammar-schools of our own country, the vernacular language was either not taught at all or very badly taught, as is evidenced by two letters written by Heine at seventeen years of age. Rector Schallmeyer evidently paid more attention to Greek and Latin, and the French authorities who then ruled would certainly not object. Where Heine acquired his knowledge of English, his biographer Strodtmann does not inform us. It was possibly at home, for his father had been in England and had named Harry after an English friend.

The time taken by his school course, and his after-course at the Universities make it probable that Harry Heine passed through his classes without much distinction. Of direct testimony there is none, for he never received the certificate usually given on leaving the school. In the spring of 1815, just when he must have begun to think of leaving, came the news of Napoleon's return from Elba. The whole of the first class in the Düsseldorf Lycée volunteered to go into the army; some members of it actually served through the campaign which ended at Waterloo. But though Heine and the majority of the class did not quit Düsseldorf, the school routine was broken, and there is consequently no official testimony of how young Harry Heine had acquitted himself during the six years of his school life.

The question of a career for the future had now to be faced. What would have suited him best—a University course and some official position at the end of it—was not to be thought of. In the first place his parents were scarcely rich enough to bear the expense, small as it would seem to us; and secondly, the only after-career open to a Jew was the

medical profession, and for that Harry had no taste. Trade in some form was therefore a necessity; so after a few months at a mercantile academy near home a situation was obtained for him in a banking house at Frankfurt-on-the-Main. This would be towards the end of 1815. He only kept his situation a fortnight, contrived to spend two months in Frankfurt, and returned home. For the next four years information almost fails. There are two letters to an old schoolfellow, written in 1816, and beyond these the only tidings we have of him is furnished by the Hamburg Directory, which shows that in 1818 a commission agency for the sale of English manufactured goods was opened there under the style of Harry Heine & Co., and liquidated in the spring of 1819.

Here is an extract from the earliest letter of Heine's now extant. It is addressed to Christian Sethe, an old schoolfellow, and is dated—" Hamburg, July 6th, 1816. . . . . How are things with you, old chap? Make me as glad as a lord or a king if you write me a jolly letter. Do, there's a good fellow. But I can't pray much, even to God. All right with me. My own master, and so independent and firm and proud and tall! And I see other people so far below and so small, so pigmy small. It's fine! You remember the old braggart, Christian? And yet—

> When the moment comes that my heart upswells,
> And foaming enchantment from my bosom wells,
> I grasp then the stylus in swiftest storm,
> And picture in words the magic form.

. . . . This cursed brag! It seems as if the Muse had been faithless, and stayed behind when I came north and let me come alone. She is only a woman. Or was she afraid of the horrid peddling that I am doing? True it is—this is a beastly den of traders. Plenty of w— but no muses.

Many a German singer has sung himself into a consumption here already. Must tell you something,—

> Walking lately Ottensen way,
> I stood by the grave where Klopstock lay,
> Much smug and well-drest folk were there
> Binding the tombstone with garlands fair,
> And smirking each at the other one,
> And thinking wonders of what they had done.
> But I stood on that sacred spot,
> Quite still I stood, and words came not;
> My soul had pierced down, down so deep
> Where the saintly singer was sleeping his sleep—

There! Even at Klopstock's grave, you see, my muse is dumb. . . . . Rejoice, rejoice! In four weeks I see Molly!

"With her my Muse will come back too. I have not seen her for two years. Old heart, how glad thou art, and how loud thy pulse! Goodbye, dear Christian; remember me."

The next letter is so long that I can only give some extracts from it. It is dated Hamburg, October 27th, 1816, is addressed to the same friend, and begins:—

"She loves me *not!* O Christian, you must pronounce that last little word quite low, quite low. The other three contain an everlasting heaven, but that an everlasting hell. If you could only look at your poor friend's face and see how pale and distracted and mad he is, your righteous wrath at his long silence would soon be appeased; though it would be best if you could look down into his very soul, then you would love me indeed! . . . .

"I believe I told you long ago that there was something in your face, and chiefly in your eyes, that in some inconceivable way at once repelled and attracted me very strongly. I could fancy in one instant of time that I perceived both kindly goodwill and the bitterest, scornful, ice-cold mockery. And

lo! this same enigmatic something I have found again in Molly's eyes. That is what confounds me so utterly. And although I have the most positive and incontrovertible proof that I am anything but loved by her,—proof that even Rector Schallmeyer would recognise as thoroughly logical, and not feel bound to supplement on his own system,—yet will the poor fond heart not give its *concedo*, but keeps on saying, 'What is your logic to me? I have a logic all my own!' . . . .

"Another thing that cuts me to the heart is the bitter and scornful way in which she puts down the pretty songs I have written for her alone,—she treats me abominably about them. But, as you may easily believe, the Muse is dearer to me than ever, in spite of that. She has become my faithful and comfortable friend, so secret-sweet,—and I love her right heartily. How those words of Goethe in *Tasso* come home to me now!

> 'Now all is gone! Yet something still remains—
> For Nature hath endowed poor us with tears,
> And with the shriek of pain when man at last
> Can bear no more. And I have larger favour—
> For in my pain she left me music,—speech—
> My sorrow's deepest fulness to bewail;
> And when the man for anguish must be mute,
> Gave me a god to tell what woe is mine!"

"I write a great deal, for I have plenty of time—great speculations do not give me much to do. Whether my present compositions are any better than the old ones, I know not. One thing is certain, they are far gentler and sweeter, like pain dipped in honey. By and bye—that may be months away yet—I mean to have these printed. But here's the rub—as they are mere love-songs they will do me a lot of damage as a tradesman. I cannot well explain it, for you do not know the spirit that prevails here. Besides

which—to you I can speak out—in this chaffering place there is not the smallest appreciation of poetry, beyond wedding, funeral and christening *carminades*, done to order and paid for in advance. And then there is lately sprung up a sultry state of tension between Jews baptised and unbaptised. (All Hamburgers are Jews to me; those whom I call baptised Jews, in order to distinguish them from the circumcised, are called *vulgo* Christians.) Under these circumstances, it is easy to foresee that Christian love will not refrain from jostling aside the love-songs of a Jew. . . .

"I am living quite alone here—from the hints given above you will easily guess why. My uncle lives in the country. Everything there is very stately and long-tailed, and the free and easy poet sins very often against etiquette. Fine-feathered diplomatists, millionaires, reverend senators, &c., are not my sort. But that glorious, Homerically godlike Blücher was here lately, and I had the good fortune to dine in his company at my uncle's table. There is some pleasure in a fellow like that.

"The nephew of the great (???) Heine is welcome and well received *everywhere*; pretty girls ogle him, tuckers are agitated, and mothers calculate,—but—but—I am still lonely,—none stick to me but myself. . . . .

"In the religious direction I shall have wonderful things to tell you soon—perhaps. Is Heine gone mad? I hear you say. But indeed I must have a Madonna. Will the heavenly supply the place of the earthly? I want to drown my senses. It is only in the infinite deeps of mysticism that I can whelm my infinite pain. How poor a thing is knowledge now, seen in her beggar-robe! What once seemed transparent clearness now shows itself as mere nakedness. 'Became as a little child!' I long thought I understood that word. O foolish fool I! Children *believe*."

These two letters, written when Heine was barely seven-

teen years of age, tell us something of his circumstances, but more about his character. We gather from the words he uses that he was not in any employment as a subordinate, but was trying to establish a business of some sort on his own account. And we see—or think we see—that the young poet who quarrelled alike with Hamburg and his fellow Israelites for their commercial propensities was not likely to succeed in business. But for posterity the most important thing shewn in these letters are his loves for Molly and the Muse. They can never be separated in idea; in fact, they seem to be but one passion, so closely are they twined together during the best years of his life. The "Molly" of these letters, and the immediate cause of all, or nearly all the poems by which Heine is best known, was Amalie Heine, a daughter of his uncle Solomon, born in 1800, and therefore a few months younger than himself. As he says in the first of the two letters quoted that he has not seen her for two years, it puts the beginning of his passion at a very early age indeed. A few years later he summed up the story of his love in these lines. (*Lyrical Intermezzo* xxxix.)

"A stripling loves a maiden,
Another to love chooses she,
The other loves yet another
And then with that other weds he.

"The maiden then weds in vexation,
What cares she?—Tom or Will—
He happened to ask at the moment—
The stripling takes it ill.

"Ah, yes! it is an old story,—
And yet it's always new;
And whom the story fitteth
His heart is rent in two."

What the "former compositions" are to which he refers

in the letter, we have no means of knowing. So far as we know, the earliest of his poems which we possess dates from 1816—the year of these letters. His first appearance in print was in a periodical called *Hamburg's Wachter,* three numbers of which, for February and March, 1817, contain poems signed with a clumsy anagram, composed from the letters of his own name and the name of his native town. Some of the pieces are, as might be expected, not worthy of his later fame; but the following ballad is as fine in its way as anything that I know :—

"A strange and gruesome dream of night
Filled me with fear and strange delight;
Still many a horrid form floats round,
And in wild waves my heart does bound.

"It was a garden wondrous fair,
And blithely would I pass time there;
The lovely flowers gazed up at me—
O, it was pleasant there to be!

"The little birdies all about
Love's merry melodies poured out;
The red, red sun bright golden beamed;
The flowers in all gay colours gleamed.

"Sweet herbs balsamic odours waft,
The breezes breathe so soft, so soft!
And all is smiling, all is bright
And all displayed for my delight!

"And midmost in this flowery land
I saw a marble fountain stand;
And then a fair maid met my sight
Who, busy, washed a garment white

"Her cheek so sweet, her eye so mild,
So gold-haired, saint-like, undefiled—
And when I look, that maiden lone
Is strange to me, yet strangely known.

"The lovely maiden works with speed,
Hums a low song and takes no heed:—
—— Trickle, trickle, little stream,
Wash the fair white linen clean!'

"And then I went and nearer drew,
And whispered low:—'O tell me true,
Thou maiden sweet and wondrous fair!
For whom the gear thou washest there?'

"Then quick she spoke:—'Thy time doth fleet!
For thee I wash this winding sheet!'
And scarce those words the maid had spoke
When all the vision foam-like broke.

"Then borne by magic swift I stood
Within a dark and savage wood;
The tall trees seemed to pierce the sky,
And dreaming, dreaming, there stood I.

"And hark! dull echoes tremble round—
Like far-off axe-strokes is the sound—
Through bush and briar I hurry fast,
And reach an open place at last.

"And there amid the green space free
Rises a mighty, old oak tree—
And lo! my old dream's wondrous maid
Hews at the stem with shining blade!

"Fast and more fast the strokes now wax,
She hums a song and swings the axe:—
'—— Iron clink, iron clank,
Hew me straight the oaken plank!'

"And then I went and nearer drew,
And whispered low:—'O tell me true,
Thou maiden sweet and wondrous fair!
For whom the plank thou hewest there?'

"'The time is short,' she swiftly said,
'Thy coffin this when thou art dead!'
And scarce those words the maid had spoke,
When all the vision foam-like broke.

"It lay so pale, it lay so wide—
The bald bare heath and nought beside!
I knew not either how or why,
But inly shuddering, there stood I.

"And further even now I fly,—
Anon a pale wraith I espy—
I hasten on—and there, yea, there,
I find again my maid so fair.

"On bleak wide heath white stands the maid,
And digs a grave with broad bright spade;
Scarce dare I look or lift my head,
So fair is she and yet so dread!

"The lovely maiden works with speed,
Hums a low song and takes no heed:—
'—— Spadie, spadie, true and tried,
Dig the grave both deep and wide!'

"And then I went and nearer drew,
And whispered low:—'O tell me true,
Thou maiden sweet and wondrous fair,
For whom the grave thou diggest there?'

"Then quick she spoke:—'Be still! and see—
A fine cool grave I've dug for thee!'
And as the fair maid so replied,
The grave's mouth opened yet more wide.

"And down I gazed, and gazed my fill,
And through me ran an icy thrill;
Into the deep grave's darksome night
Headlong I fell——and woke in fright!"

The poet's love thus seems to have been unhappy almost from the beginning; and during the next few years we find the images of death and a fair maiden constantly recurring in his poems. But "Molly" is never mentioned in any of his letters after these two first, till 1827, when she had been several years married. His love was a genuine and hopeless passion which could find expression only in the divine

tongue given to him by nature—poetry. And that glorious gift has enabled him to transform his pain into a thing of beauty for all mankind for the rest of time. Many of his poems, like the one I have just quoted, might be read separately without raising any suspicion of the feeling that prompted them; but when a long series of them is found to harp continually on similar ideas, it begins to force itself upon even a careless reader that there is some great unhappiness underlying them all.

The only important poem of Heine's youth which has no reference to his love or his sorrows, is a piece which ought to have been written by a Frenchman, and not by a German youth who only about a year before had volunteered to fight the French. This is the "Two Grenadiers." It describes the return of two French grenadiers from captivity in Russia. As they approach the German frontier, they are met by the news of the defeat of the army and the captivity of the Emperor. One of them feels the hand of death upon him, and thinks of his wife and child—

"But what care I for child or wife?
For better than they I am dying;
Let them beg their bread—let them live their life!
The Emperor a captive is sighing!"

He begs his comrade to have him buried in France, in full regimentals, with the cross of the Legion of Honour on his breast—

"So let me lie when life is o'er,
A listening sentinel buried,
Till I hear once more the cannon roar
And the neighing horse tramp close and serried.

"And then when the Emperor shall ride o'er my head,
And swords their wild music yield him—
Then armed for the combat I'll start from the dead—
The Emperor! The Emperor! I'll shield him!"

But scraps of poetry published in newspapers or magazines would not bring the young man his daily bread, and by 1819 it was evident that commerce would not do it either. On the winding up of the commission agency in that year, Uncle Solomon came forward and offered to find Harry in funds for a three years' course at a University, on condition that he would study law. I have already said that the medical was the only learned profession open to Jews. The stipulation, therefore, that Harry Heine was to study law contained the further condition that he should turn Christian —in form at least—if he desired either to hold office or to practice as an advocate: a strange condition for one Jew to impose on another, and the imposer a Jew who adhered scrupulously to the doctrine and practice of Judaism in spite of the annoyances and disabilities which he thereby incurred. But he had found in practice that he was able to heap up riches without turning his back upon the oppressed community which had given him birth, or renouncing the faith which had sufficed to his fathers. Religious apostasy had therefore been to him a superfluous humiliation, from which pride of race and natural manliness and kindliness would combine to restrain him. That it was not religious conviction which withheld him is testified, I think, both by his treatment of his nephew and by the fact that several of his children married Christians. There must have been something of the same freedom from religious prejudices in Samson Heine's family, despite a careful observance of Mosaic prescriptions. Heine describes Rector Schallmeyer as recommending Madame Heine to send her son to Rome and have him educated for the Church; the Rector had influence and could promise some good place for the young man. On this Heine exclaims :—" O what a happy mortal is a Roman *abbate*, who serves not only the Church of Christ but also Apollo and the Muses! . . . . The writer of

these pages had just the stuff in him to make such an *abbate*, and to lounge in sweetest *dolce far niente* through the libraries, galleries, churches and ruins of the Eternal City, studying in enjoyment and enjoying study. And I should have read Mass to the most select audiences, and preached the strictest morality in Holy Week, but always without degenerating into ascetic rudeness. I should have edified the Roman ladies, and perhaps by their favour and such merits have arrived at the highest dignities of the Church. I might have become a *Monsignore*, a violet-stocking—a red hat might even have been found to fit my head, and then, as the proverb says—

> 'There is no priestling e'er so small
> But would be Pope and rule them all.'

So might I even have risen to that most honourable post—for although I am not by nature ambitious I would not have refused the nomination to the Popedom if the choice of the Conclave had fallen on me. It is a very becoming and well-endowed office, which I could have filled with sufficient ability. . . . . And then, *in pontificatibus*, triple crown on head, and surrounded by a brilliant staff of red hats and mitres, walls of gold brocade, and monks of all colours, My Holiness would have shewn himself on the lofty balcony to the people kneeling with bent heads far below in undistinguishable and infinite swarms, and I should have quietly stretched out my hands and pronounced the blessing, *urbi et orbi*."

How did Harry regard his uncle's proposal? Much as I suppose his uncle himself would have done. There was a flavour of baseness about the act which caused repulsion at the time and bitterness in all afterthought of it; but it seemed a necessity, and therefore in some sort outside morality.

I cannot call it a conversion when Harry Heine makes up his mind to adopt the religion of the state—he was as much a Jew and as little a Christian after his baptism as before it—as much, and as little. There was no religion to change. My conclusion is that Heine was one of those minds which are absolutely incapable of religious belief. I suspect that such minds are really numerous. Many will never be conscious of their own incapacity, and many of those who are aware of it will avoid all display of or reference to it, as they would with bodily infirmity or deformity. Many also will avoid saying or doing anything to weaken the hands of a religion which appears to be the highest moralising influence in society as at present constituted. To these, religion is a sort of transcendental police with which all good citizens will try to be on good terms, as they are unable to suggest anything better to put in its place. But Heine fell into none of these categories. He was fully conscious of and not afraid of shewing his unbelief; for him the Jewish and Christian mythologies stood on exactly the same level as the old pagan systems, and instead of being the foundation of morality they were in reality the no longer weather-proof roof. This assumption of Christianity was therefore a purely political act, and in nowise altered his position with regard to Judaism, as the course of his life will shew.

In the autumn of the year in which the firm of "Harry Heine and Co., commission agents, Hamburg," ceased to exist, Harry Heine was entered as a candidate for admission to the University of Bonn. As a consequence of the military and patriotic ardour of the Düsseldorf Lycée he was unprovided with the usual certificate of study, and had to submit to an entrance or matriculation examination. Among the papers set there was one on the object of University training. Heine treated the subject humorously, and so freely that the examiners pronounced that, though he had wandered con-

siderably from the text, it was not to be denied that he displayed a remarkable talent for satire. However, he received a certificate of fitness, and matriculated December 11th, 1819, as a student in Jurisprudence and Finance.

Although it was only on condition that he should qualify for the law that his uncle had sent him there, the studies proper to the profession were at first completely neglected. But he worked hard at literary and historical subjects. We have only two letters of Heine's bearing the date of 1820, but in one of them he writes to a fellow-student who had quitted Bonn :—"I could tell you a lot of fine things about my acquaintance with Schlegel (August Wilhelm Schlegel was one of the professors). He was much pleased with my poems, and seemed almost pleasantly surprised at their originality. I am too vain to wonder at that. But I felt quite set up when Schlegel gave me a formal invitation, and we talked away over our smoking coffee-cups for a full hour. . . . His first question always is how am I getting on with the publication of my poems. . . . Unfortunately the many alterations I have made at Schlegel's suggestion have forced me to write out many of the pieces anew, and to add a lot of new ones and some translations from the English. I am doing the latter particularly well—they will serve to shew my poetic workmanship." The same letter contains the following characteristic passage :—"Dear Fritz,—The thorns tear me every moment, but they cannot hurt me as they used to do. I see now that men are fools to make such a fuss over their mighty woes. It is not that the woes are so great, but the breast that has to contain them is usually so narrow!"

The temptations to linger in the pleasant paths of literature were too strong at Bonn. At the end of October, 1820, we find Heine at Göttingen, and the only reason he gives for the move is that it will be easier—in fact, there is

nothing there to be done but drudge. "That is what attracted me," he writes: "Often when glooming in the gloaming among the weeping willow walks of paradisiac Beul" (a village opposite Bonn, on the Rhine, where he had passed the vacation), "have I seen floating before me in transfiguring glory the shining genius of drudgery in dressing-gown and slippers, holding up in one hand Mackeldey's "*Institutions*," and pointing with the other to the towers of Georgia Augusta (Göttingen). The very waves of the Rhine admonished me ever and anon—

Ox like, German youth, now tramp it—
Trudge and follow still thy tail;
Once thou'lt rue that e'er thou scamped it,
Wasted days will surely fail!

Doesn't that sound tragical?"

But at Göttingen, as at Bonn, he neglected his legal studies for literary ones—lived an unsocial life, and left it even more quickly than he had quitted Bonn. On the 23rd of January, 1821, Harry Heine received from the University authorities a six month's *consilium abseundi* for breach of the duelling regulations.

A slight indisposition served as a pretext for remaining a few weeks longer at Göttingen until it could be decided from home to which University he should proceed in order to complete his studies. From an expression used in a letter dated the 4th February, I think he did not inform his family of the true cause of his quitting Göttingen. However that may be, in the last days of February he received his orders and set out for Berlin.

Although it might be rash to assert absolutely that the life of a great city was a necessity for the full development of Heine's poetical powers, I think it may safely be said that the circumstances and the society into which he was

introduced on his arrival in Berlin were pre-eminently calculated to hasten that development.

But his immediate purpose in going to Berlin was educational in the narrower sense—it was the University and not the capital that attracted him. The University was but young, but the names of its professors, Fichte, Schleiermacher, Wolf, Niebuhr, Bode, Savigny, Klaproth and Hegel were a guarantee that its teaching was the best obtainable. Still, more important perhaps than all these to Heine was his introduction into the very inner circle of German literary society. We are not told how it came about (and the "how" is of little importance), but immediately after his arrival we find him with the *entrée* of Councillor Varnhagen von Ense's house. There, in a *salon* presided over by Madame Varnhagen, he met the very cream of the wisdom, wit, and poetry of Berlin. Madame Varnhagen tried to draw Heine into the little circle of Goethe-worshippers of which she was the centre, but he never went beyond a very cool and critical admiration. Goethe was still alive, and it was the custom of the little band of worshippers to celebrate his birthday with verses and speeches and various festivities. Strodtmann gives the following as a specimen of the verses :—

"I would I were a fish,
So nice and so fresh,
And quite without bone!
For Goethe alone
Were I fried as a dish
Of savoury fish!"

Heine declined to appear in such company, and it is hardly to be wondered at.

Among the literary notabilities whom Heine met in Madame Varnhagen's assemblies may be mentioned, Chamisso (author of *Peter Schlemihl*), Häring (better known as

Willibald Alexis), De la Motte Fonqué and his wife, Ludwig Robert (Madame Varnhagen's brother), Michael Beer (a writer of tragedies, and brother to Meyerbeer, the musician), and a Prof. Gubitz, a periodical conducted by whom was the means of introducing Heine's poetry to the Berlin public.

At Bonn and Göttingen, Heine had held aloof from the society of Jews, as was to be expected from the writer of a letter quoted earlier in this paper, in which the Jews of Hamburg were mentioned so scornfully. But in Berlin Heine fell in with a circle of enlightened Jews who were trying to raise their brethren from the degraded state into which centuries of persecution had sunk them, and he joined enthusiastically in the work of a "Union" which they had formed for the promotion of science and culture among the Jews. Writing in 1844, Heine describes the Union as pursuing "a soaringly great but unrealisable idea," and sums up its work thus:—"Intellectually gifted and great-hearted men were here attempting the salvation of a cause lost long ago, but all that they succeeded in doing was in recovering from the battle-fields of the past the bones of former champions. The whole harvest of the Union consists in a few historical works and researches, among which Dr. Zunz's treatise on the *Spanish Jews of the Middle Ages* must be accounted one of the memorabilia of the higher criticism." Perhaps if he were alive now the object of the Union would not seem so unrealisable, but even when working enthusiastically for the Union there was one reform in which he had no faith. Nearly half a century earlier Friedländer and a few enlightened Jews had perceived that one of the surest means for introducing "sweetness and light" among their brethren was the use of the vernacular German in their worship. Heine speaks of them as "Friedländer and Co., a firm of corncutters." It was in its literary and scientific aspect that the Union appealed to his sympathy, and in addition to acting as

secretary he lectured three times a week for several months, at the end of which time his health broke down. The subject of his lectures was history, presumably Jewish, but the lectures seem to have been lost. He remained in Berlin till May, 1823, when the state of his health obliged him to pass the next few months in the quiet family circle now established at Lüneburg, where in spite of almost continual severe headaches he prosecuted his legal studies, which he seems to have neglected in Berlin as at Bonn and Göttingen. In spite of some disagreeble passages between them, his uncle was induced to extend the time for study. In the beginning of 1824 we find him again at Göttingen, this time really bent on taking his degree, which he received on the 20th July, 1825. Three weeks previously, on the 28th June, he had been privately baptised in the little town of Heiligenstadt, a few miles from Göttingen, and then changed his name of Harry to Christian Johann Heinrich. There is no need to dwell long on this act. Here are a couple of extracts from letters to show how it was regarded by Heine himself. The first is dated September, 1823, nearly two years before. ". . . . So in spite of my headaches I am working away at my law—it will have to get me my daily bread in the future. Here, as you know, the question of baptism comes in. No one in the family is against it except myself. And this self is of a very stubborn nature. You will easily deduce from my way of thinking that the act of baptism is of no importance to me, and that I even attach but little weight to it symbolically; and also that from the circumstances with which it will be connected in my case it can have no significance to others. To me it might signify that I should dedicate myself still further to the championing of the rights of my unhappy kindred. But still, I hold it below my dignity and a stain on my honour that I should submit to baptism in order to qualify for office in Prussia,—in Prussia, of all places!!!

In my wretched position I really do not see how to help myself. I could turn Catholic for spite and hang myself." This last phrase seems to be a proverbial way of expressing extreme vexation. The other letter is without date, but probably was written in October, 1825, a few months after taking his degree. "Talking about books, I can recommend Golowin's *Travels in Japan*. You will see there that the Japanese are the most civilised people in the world. I would say the most Christian people, only that to my astonishment I read that there is nothing they hate so much, nothing that they hold in such horror, as Christianity. I will turn Japanese. Nothing they hate like the cross. I will turn Japanese." The root of the matter, however, is contained in another passage where he says expressly that he has not force enough to fast and wear a beard and be called a snuffling Jew. And after all, his apostasy brought him no profit, as was fitting.

I have already stated that Heine's poetical efforts date from 1816, but in addition to being one of Germany's most gifted poets he is also one of her greatest prose writers. I have no space here to discuss him in this latter quality; it must suffice to say here that his prose has all the lightness and brightness of the best French prose combined with qualities peculiar to himself. I know of no German author more easily read by Englishmen with only a moderate knowledge of German. The list of his prose works up to the time at which we have arrived, begins with a short magazine article on *Romanticism*, published in 1820, and in the years that follow we have, besides reviews and magazine work, *The Rabbi of Bacharach*, *Letters from Berlin*, *On Poland*, and *The Hartzreise*. Of these the *Hartzreise* is the best known in this country.

His poetical works begin with *Youthful Sorrows*, published in 1821. This little collection includes the early poems

already mentioned. In 1822 he published two tragedies, *Almansor* and *William Ratcliffe*, with a *Lyrical Intermezzo*, and in 1824 another collection of short pieces, under the title of the *Return Home*.

With the exception of a very few pieces the one subject of the poems up to this date is love, and mostly unhappy love, but everything is treated so *objectively*, to use a German phrase, that it is only the constant harping which betrays that the author's own sorrows are the subject, and there is sufficient variety to prevent any feeling of monotony. There are also a few sonnets which express a fierce Byronic kind of anger at the basenesses of the world, which, albeit no mention is made of religion or politics, are probably the symptoms of his revolt against the circumstances in which he was placed. The following will give an idea of them :—

> "Give me the mask ! The form will I assume
> Of some rude clown, lest that foul rout obscene,
> That proudly strut in character, should ween
> That I and they are birds of but one plume.
> Give me low words and manners ! I'll entomb
> My better self in mob like form unclean ;
> The fine soul-spark within shall be unseen,
> With which to play insipid quacks presume.
> So masked, I'll caper in the great masked ball,
> And all the swarming kings, knights, nuns, I'll view,
> Greeted by Harlequin and known of few.
> With lathen swords they beat me, one and all.
> Therein's the jest. But should they see me right,
> At once the gallows-pack were mute with fright."

Here we have the note of conscious or fancied superiority which was given out in the first letter quoted in this paper, and it is a note which occurs again and again all through Heine's works, whether verse or prose, to the end of his life. Still, in the early years, strains like the following are more usual and characteristic :—

"Lo, to join melodious battle,
Minnesingers all are bent;
Strange will be the strife and rattle,
Rare and strange the tournament.

"Foaming fancy now must yield him,
As the minnesinger's steed;
Art be buckler strong to shield him,
Keen words be his sword at need.

"Lovely ladies—many a bright one—
Look from rich-hung gallery down,
But alas! there wants the right one,
With the right green laurel crown.

"Other knights, when lists they enter,
Wield the strength that health imparts;
Sole, we minnesingers venture
With wide deathwounds in our hearts.

"And for him whose song blood raineth
Fastest from his cloven heart—
He is Victor—he constraineth,
Best praise fairest lips to part."

"I wandered alone in the greenwood—
Alone but for my pain;
And then my old, old dreaming,
Slipt into my heart again.

"That little word, who taught it,
You birdies so high in the air?
O silence!—if my heart caught it
The woe would be hard to bear.

"'There came a maiden who thought it,
And sang it like any bird—
And so we birdies caught it,
That beautiful golden word!'

"To none shall you dare reveal it,
O birdies wondrous sly!
My trouble, I know ye would steal it,
But none will I trust—not I.

"My songs are full of poison—
How else, dear, could it be?
For thou hast filled with poison
The life that was blooming in me.

"My songs are full of poison—
How else, dear, could it be?
I have in my heart many serpents,
And, dearest, I have thee."

There is no room here to say much about the two tragedies, but when I state that in both the hero and heroine perish by the act of the hero, and that in one, *Almansor*, the plot consists mainly of complications arising from the conversion and non-conversion of Spanish Moors to Christianity, it will be plain that the poet's own life enters largely into them. But Heine succeeds better than Lord Byron in disguising his own personality. This reference to Byron is not an accident. Byron and Heine have much in common, and Heine was aware of it. In a letter dated June 24th, 1824, he says:— "Byron's death disturbed me greatly. He was the only man with whom I felt myself akin, and we may well have resembled each other in many things, laugh at it as much as you will. For some years past I have read very little of him; we keep company rather with those whose character differs from our own. But I was always comfortable in Byron's company, as with a perfectly equal playfellow. In Shakspere's company I am not comfortable, I am all the while too conscious that I am not his equal—he is the all powerful Minister—I a mere councillor—and I feel as if he might dismiss me at any moment."

If I were to speak my mind here as to Heine's character as a man, I should have to do it with a mass of evidence lying clearly before me which I have not been able to bring before the Society. The sketch which is contained in the foregoing pages is only a sketch, but although much is necessarily left

out, I hope I have succeeded in placing before you an outline of the man and the circumstances which is not misleading, but may at some future time be completed by the addition of details now omitted. Heine's writings, outside his poetry, are concerned much with politics and much with religion. The indications given in this paper are more than sufficient to shew that his standpoint will differ so widely from that of the great majority of English people, and that his treatment will be so free as to be inevitably a cause of offence if his works were to be heedlessly introduced into a Society like this. At the same time, a man who aspired to be a poet, a novelist, a historian, a philosopher, a critic, and a politician, and really by virtue of his innate poetic insight achieved success in each of those departments—such a man is one whose works every succeeding generation must study, and if I can make that study easier to some of my countrymen, I shall be well pleased with the labour I have spent on the work.

YGGDRASILL
(The great World Tree.)

SCANDINAVIAN MYTHOLOGY FROM THE PICTURESQUE SIDE.

By MISS JESSIE MACGREGOR.

It is at first sight difficult to understand why the old Norse Mythology, though it lingered in remote corners of the north so late as the eleventh century of our era, influenced the Europe of the middle ages so little as it certainly did. A strange phase of northern thought, expressing the ruggedness and the earnestness of the northern character, it seems to have vanished utterly, leaving few evidences of its past existence; no flavour of its poetry in mediæval literature, no trace of its picturesque imaginings in mediæval art, for sculpture and painting are alike silent concerning it, and only in architecture and ornament do we find that northern ideas, influenced by traditions derived from Greece through Byzantium, formed the beginning of Gothic; for Gothic architecture, I suppose, is mainly the outcome of northern genius. Some explanation of this may be offered in the fact that after the Teutonic peoples received the Christian faith, and the wandering Norsemen settled down, they seem to have adapted themselves pretty readily to circumstances and to have become devout sons of the Church. She gathered into her coffers not only "jewels of gold, and jewels of silver," but all the treasure of intellect and genius: and as monks and priests, besides being the patrons of learning and art, were also the scholars and in many cases the artists themselves, it followed as a matter of course that aught that savoured of heathenism was discouraged and disallowed. Whenever, through poetic license, Paganism did creep into literature, as in the *Divine Comedy* of Dante, where

Florentine and classical personages were mixed up, the allusions were to southern myths; and Rome—a centre once of Pagan thought, as then the heart of Christendom, rich in classic memories, contiguous, too, to classic Greece—Rome and her luxurious civilisation were in all senses too far removed from Scandinavia to catch even an echo of her faith, or, catching it, to be influenced thereby.

In mediæval art (though the Dutch have left us precious memorials of what may be called the domestic school, in the painted records of their burgher lives), it is unquestionable that with few exceptions the masterpieces were inspired by Christian themes. No trace is there anywhere of the religion of Odin; for when the old masters, weary of their strangely comfortable St. Sebastians delightfully oblivious of showers of arrows; weary, too, of their beautiful Madonnas, grand entombments and crucifixions, turned to mythology for fresher themes, they sought them naturally on classic ground, knowing nothing of the north. Titian knew nothing of it when he painted that Bacchus and Ariadne in our National Gallery of which Mr. Ruskin somewhere says that it is the finest picture in the world. But Titian was an Italian, and the loveliest story of Scandinavia would have conveyed to him no meaning; nor is it too much to say that, genius though he was, he would have expressed no meaning by it;—in breathing his southern soul into the myth he would have robbed it of its northern character.

Now I think that though the Mediævals drew sufficient inspiration for their masterpieces from such sources as those referred to (viz., Scripture and the lives of the saints, classic lore, and domestic life), the men and women of the nineteenth century need not hope to do the same. Religious art is well-nigh a thing of the past; though we have great painters still among us, we do not get such pictures as Raphael and Leonardo painted. Is this because the lively, simple faith

of the old masters has quite departed from among us? I think not; but if it were so it would not be altogether a deterrent fact, for those living artists who paint noble pictures suggested by time-worn Greek myths; our poets, who, like Mr. Lewis Morris in his *Epic of Hades*, still return to these stories for their material, cannot be said to "believe" them in the sense we apply to the words "I believe" in the Creed; but they have vivid imaginations, and the power of projecting themselves, so to speak, into the mental attitude of the ancients. That sacred subjects are now avoided, is mainly the fault of the public. The great religious works of the past were in demand for monasteries and churches; but we Protestants are unable to see that in decorating our churches and chapels with our finest works of art we should be dedicating God's noblest gifts to his praise, and we have small space or place for them elsewhere. Thus religious pictures, perhaps the most delightful of all to paint, have become drugs in the market. The same thing holds good in literature, though for a different reason; much of the culture of the day has been turned by an agnostic generation into other channels of thought. Let a good poet arise and write a sacred epic after the manner of *Paradise Lost*, and I do not think that his work would get through a first edition!

It may be urged that domestic and historical scenes still remain. As to the first, I believe that, *left to themselves*, few men of genuine feeling would paint kittens and babies, widows and widowers planting flowers on graves, or girls sitting on stiles reading letters or listening to nightingales; such sentiment is too easily obtained, and too much on the surface to be of value. Yet such are the favoured themes against which thoughtful critics inveigh, and they are not inspiring; the stimulus to paint them, however, comes from without, not from within. The public insists on having that kind of art, and therefore the artists crush down their best

instincts and give what is demanded, knowing that the thoughts they long to utter would find no hearers.

Of historical painting there is none, I think, properly so called, except the representation of the life of to-day, of the life with which the painter is himself familiar. A picture of Cromwell dismissing the Long Parliament, if such a subject were capable of picturesque treatment, though painted by Pettie or Yeames, would be worthless as a record of actual fact, however precious it might be as a work of art showing subtle analysis of character and rendering of expression.

On the other hand, Mr. Du Maurier's society drawings in *Punch* will be *historical* to posterity; and so also would be a true picture of the kaleidoscopic movement and human interest of any street in Liverpool on this 7th of January, 1884.

Whether this contemporary life of ours is worthy to be perpetuated in art is another question. The nineteenth century is pre-eminently the age of the novelist, and the novel is the mirror which best reflects our manners, our foibles, and our virtues; but there are many among us to whom the life of to-day offers no charms for brush or pencil. I find in the *Spectator* of Saturday, July 28th, 1711, that "Great masters of painting never care for drawing people in the Fashion; as very well knowing that the Head-dress or Perriwig that now prevails, and gives a grace to their Portraitures at present, will make a very odd figure, and perhaps look monstrous in the eyes of Posterity. For this reason they often represent an illustrious Person in the Roman habit, or in some dress that never varies." Yet the costume of the eighteenth century was more picturesque than ours, particularly the masculine costume; and I honestly think that more may be done in a picture with a full-bottomed wig than with a chimney-pot hat. But artificiality and fashionable ugliness are out of place alike in the art of every age; so, too, is the *un*fashionable squalor, of which we read

less in the pages of Addison than in the press of the present day. We should read about it, think about it, see it, remedy it—but not *paint* it. For true artists rejoice in lines of beauty and pure glowing colour, and they no more find the last in smoky factories, rags and grimy courts, than the first in millinery and tailor-made clothes. It is not that they lack sympathy, and fail to see all the pathos and beauty underlying the common lives of both rich and poor; but it is because art, though it has the supreme advantage of speaking a language understood by all, is nevertheless subject to certain limitations by which literature is little affected. These make it impossible to show, in the impression of one brief moment (which is all that is allowed to a picture), that hidden tragic side which, in many a society episode, lifts its seeming triviality into greatness; or that heroism of suffering lives, which once understood would redeem their ugliness. But more than this, it is the domain of art to present things beautiful to the *eye; the artist has no business to paint anything that is not in some sort beautiful.* Things that are not so are unfit for picturesque presentment. Positive deformity, the representation of scenes of brutality and vice, and of physical suffering, should always be avoided; and I say this in spite of my reverence for Hogarth as a great teacher. I think, too, that the horrors sometimes given us by the French school are not excused even by the splendour of their execution. Nor, in my opinion, are battle pieces justifiable, when the sanguinary side asserts itself rather than the heroic or the picturesque. We do not want surgical art.

As distinguished from a great poem or novel, a great picture must show some actual, visible beauty of form, colour or expression; unless it do so, however lofty its purpose, or poetic the thought which gave it birth, it is a failure, and literature would more properly express what it sought to express. It may even be a very fine picture if it teach no

lesson at all but beauty; indeed, there are many people who consider that art should seek no higher mission. I am not among their number; for though I think that one might almost die content who had given to the world "a thing of beauty" that would be "a joy for ever," I claim for art still nobler capabilities, believing that the greatest painter of all will be he who will think his own great thoughts (a Shakespeare in a new realm), who will clothe them in perfect form and perfect colour; in the grandeur of Michael Angelo, in the grace of Raphael, in the tints of Turner or Titian. But not, probably, in our generation will such an one arise.

Some living poets and painters, shut out, for the reasons before given, from the religious subjects in which their idealism might find vent, may perhaps be desirous of expressing otherwise than realistically the loveliness or the pathos of life, the mystery of death. They turn, may be, to Mythology, thinking to explain the feeling that stirs them in its profoundest stories; or else, if artists, they probably turn to it because they have been struck by the merely pictorial possibilities of a myth, without regard to its subtler meaning; they are of those who strive only for beauty, for whom "art for art's sake" is enough; and they find that ideal subjects allow unconventional treatment of drapery, free play of beautiful curves in the idealised human form, and the omission of ugly and prosaic accessories. In either case you may be sure that they have turned their backs on their native North, and found their material in the well-worn classic stories. They *are* well-worn; they have done duty over and over again; are we to have Aphrodite and Medea, or Helen and Odysseus, repeating themselves eternally, and the same tales dished up afresh in literature, when nearer home a perfect mine of heroic legend, and a mythology concerning our race much more closely than the Greek, contain the germ of many a beautiful picture and poem?

Leaving the *Saga* literature out of the question, as opening too large a field of enquiry, I think it a matter of regret that so little interest exists among us in the universal religion of our Teutonic forefathers; and it is my object to prove, as well as I can in so short a paper, by reference to some of its more salient features, that Scandinavian Mythology is as possible of elaboration by literature, and particularly as suitable for illustration by art, as its better known sister of Greece. Should there be any one here who may have thought of the old Scandinavians as of a merely half-barbaric, roving and warlike people, neither contemplative nor imaginative, I hope even this sketch of their religion will convince him that, on the contrary, they were both, and possessed capacities and instincts for art which they have bequeathed to us, and which it is our duty to develop and to illustrate.

In the light which Philology has thrown on the study of comparative Mythology, no one, I think, will controvert the statement that, in so far as all mythologies personify and worship the visibly working forces of the natural world, they have a common ground of origin. For "religion," as has been truly said, "is the apprehension of the Infinite," and the faculty which enables man to perceive the Infinite, wherever hidden, distinguishes him from the brute. The most striking natural phenomena were to the primitive mind only so many manifestations of the Infinite. Thus it is that myths which evidently have once corresponded may be met with in the religions of various races; for the sun, warming and fructifying, the teeming, all-nourishing, all-bountiful mother earth; the bright "father sky" overshadowing her; the wide ocean; the succession of day and night, and summer and winter; the gathering thunder-cloud and blasting lightning, became to all of them only so many personifications of Deity, or expressions of divine wrath or pleasure.

But nature has many aspects, is both stern and gentle, smiling and awful; therefore, according to the way in which she impressed the early thinker, to his surroundings and his habits, was the development of the myth in which he clothed his thought.

Ages before the dawn of history, when the still undivided Aryan people dwelt together in Asia, they had a mythology, and worshipped the Infinite in the great forces of nature and the "shining gods" of the heavens. When they dispersed and went east and west, north and south, becoming Hindoos, Persians, Germans, Celts, Greeks, Romans and Slavs, they took with them to their new lands a common faith, so that Indra in India, and Zeus in Greece, were the same as Dyaus, god of the bright sky, the supreme deity of the original Aryans. But, of course, the myths would not long remain the same; the most simple of these nature-allegories (for a myth is an allegory, though a half conscious one), when in the course of centuries it became the property of mixed peoples, and was subjected to the influences of changing climate, customs and language, got altered past recognition; and so much has this been the case, that, but for the comparatively new science of language, the identity of the gods of one race with the gods of another would never have been proved. If we possessed only the German version of the Scandinavian mythology, the myths being tinged with mediæval romance and local colouring, and inevitably affected by contact with Christian ideas, would now retain but little that was peculiarly Norse. But fortunately, a pure stream of Scandinavian Mythology has welled up for us from a most unlooked-for source, and may be said, literally, to have sprung from a rock barren as that of Moses in the wilderness. "God made the world, but the devil made Iceland," says a Danish proverb; and in Iceland—that sterile isle of the northern sea, buried as it were beneath lava bed and volcanic rock—the mythical poems

and heroic *Sagas* of our forefathers have been preserved as securely as ever were the cities of the Italian plains beneath the ashes of Vesuvius. Carlyle says, touching this subject, "In that strange island—Iceland—burst up, the geologists say, by fire from the bottom of the sea; a wild land of barrenness and lava; swallowed many months of the year in black tempests, yet with a wild, gleaming beauty in summer time; towering up there, stern and grim, in the North ocean, with its snow Jokuls, roaring Geysers, sulphur pools and horrid volcanic caverns; like the waste chaotic battlefield of frost and fire; where, of all places, we least looked for literature or written memorials, the record of these things was written down. On the sea-board of this wild land is a rim of grassy country where cattle can subsist, and men by means of them and of what the sea yields; and it seems they were poetic men these, men who had deep thoughts in them, and uttered musically their thoughts; much would be lost had Iceland not been burst up from the sea, not been discovered by the Northmen." It was somewhere about the end of the ninth century that the discovery here alluded to took place. In 872, Harold Fairhair united all Norway under his sway, and those of his subjects who were dissatisfied with his rule (among them the bravest and cleverest of the race) fled, and many went over to Iceland and made it their home. The religion which they carried with them into this exile flourished there until the introduction of Christianity in the beginning of the eleventh century. Even then the Icelanders seem to have received the new faith rather reluctantly; for they stipulated that they should be baptised in the hot springs in cold weather; and we hear of chieftains, nominally Christians, who never put to sea or engaged in any serious undertaking without invoking the aid of Thor. Jacob Grimm, in his *German Mythology*,* tells us of a man who,

* *German Mythology*, v. i, p. 114.

living among Christians, carried in his pocket a little image of Thor, the thunder-god, carved in whalebone, and worshipped it in secret. Also the Skald, or poet Halfred, when converted to the faith of Christ, announced that he should never speak ill of the old gods, or cease to celebrate them in his songs. No doubt the Christian doctrines of humility and forgiveness were bitter pills to the heroes of many a deed of valour and vengeance; and one can picture the flash of scorn in the Viking's blue eye when first told that if his enemy smote him on one cheek he was to turn to him the other, that if he took his coat he was to give him his cloak also.

However this may have been, the Northman's lingering love for his old religion helps to explain the preservation in Iceland, where they were discovered, of the poems called collectively the *Elder* or *Poetic Edda*, from a word generally taken to mean "Ancestress." Wherever these lays may have been first actually written down, they contain internal evidence that their writers were familiar with such distant spots as Greenland, Ireland, the Orkneys, and the Isle of Man. But they had been the property of the whole Scandinavian race before the colonisation of Iceland, and some are probably of extreme antiquity. Before the awakening of the literary spirit in Iceland, about the eleventh century, these poems and the scattered sagas had all been committed to memory and handed down from generation to generation by word of mouth, till story-telling had become a profession, and those who followed it were called Skalds, whose business it was to perpetuate the glorious deeds of their gods and heroes, and to stimulate the Sea-kings to emulate them.

The *Elder Edda*, commonly, but without authority, called the *Edda of Saemund*, a learned Icelandic priest of the eleventh century, is very fragmentary; its meaning also is in some places so obscure as to be almost unintelligible, but

many of its songs are full of a wild and original beauty, and no doubt they have lost much in translation, the peculiarly alliterative quality of the metre being difficult to render into elegant English verse. It is, however, to the *Younger*, or *Prose Edda*, generally attributed to Snorri Sturleston, a famous Icelandic chieftain of the thirteenth century, that we are mainly indebted for such knowledge as we possess of the religious system of our forefathers. Of this a very excellent translation has been published by Professor Anderson, of Wisconsin, United States. *

Most people know that the ancient Scandinavians pictured the universe as a gigantic ash-tree, the ash-tree of existence, Yggdrasil by name. The branches extended over all the world, and reached to heaven. It had three roots; one was deep down in the dominion of Hela, the pale Queen of Death. This was for ever gnawed by the dread serpent Nidhögg, which abode in Hvergelmir, the roaring cauldron of evil whence flowed the twelve icy streams of the Elivoggs. Another reached to Jötunheim, where dwelt the Jötuns, or giants, personifications of the phenomena of nature hurtful to man, such as frost, snow and storm. It would therefore appear that the old Norse held that death, evil and the cruel elements, *i.e.*, Hela, Nidhögg and the frost-giants, are at the bottom of all the woes of the world. The third root of the ash was with the gods in heaven. Honey dropped from it, an eagle sat above in its boughs, and a squirrel ran up and down carrying messages to the serpent below, making mischief between it and the eagle; four harts gnawed its branches, whilst the Norns or Fates—Urd, Vernande and Skuld (past, present and future), who weave for weal or woe the destinies of men—watered it daily with water from the sacred fountain of Urd. Near this fountain was Bifrost, the rainbow-bridge

* *Vide The Younger Edda*, called also *Snorri's Edda*, and *The Prose Edda*, translated by Rasmus B. Anderson.

which led from earth to heaven, of which the god Heimdall was the guardian.

I can only briefly refer to the very grotesque account in the Norse Mythology of the creation. In the words of the *Elder Edda*—

"It was Time's morning
When there nothing was;
Nor sand, nor sea
Nor cooling billows.
Earth there was not
Nor heaven above,
The Ginnungagap was
But grass nowhere.

Ginnungagap means the yawning gap, and by it was represented empty space. Muspelheim was the world of dazzling light, guarded by Surt, the fire-giant, who at Ragnarök, "the dooms-day" of the gods, was to come and burn up the whole earth with fire. Niflheim was the world of mist, which together with Muspelheim existed before creation. We are told that the heated blasts from Muspelheim met the rime and cold and "all things grim" which proceeded from Niflheim, and turned them into drops. These "by the might of him who sent the heat" (a phrase thought by some to point to an older worship than that of Odin, by others to be merely an interpolation of a later writer), quickened, and took the likeness of the frost-giant Ymer. There follows much more telling of the giant's offspring; of chaos and the creation of Odin and his brothers. These last slew the giant, and drowned in his blood the whole race of frost-giants, except one Bergelmor and his wife, who escaped in their Ark. In this incident we light strangely on the story of the Deluge; the story of Noah, and of Deucalion and Pyrrha. Odin and his brethren took the body of Ymer, and throwing it into the midst of the Gulf Ginnungagap, created therefrom the universe.

Says the " Lay of Grimnir " in the *Elder Edda*—

"Of Ymer's flesh
Was earth created,
And of his blood the seas;
Rocks of his bones,
Trees of his hair,
And of his skull the sky;
And of his brows
The gentle powers
Made Midgard for
The sons of men,
But of his brains
The melancholy clouds
Were all created."

The Norsemen had a genuinely barbaric love of splendour, and all the halls in Asgard, the place or city of the gods, are described in the *Eddas* as glittering with gold and silver. Most celebrated of all was Valhal, whither carried in the arms of the Valkyrs, or Valkyriur (the shield maidens and messengers of Odin, whose name signifies "choosers of the slain"), went the souls of heroes slain in the battle-field; those who otherwise met death, fared to Hela the death queen, represented as half-corpse, half-woman. It is the opinion of the latest writers that the notion of Valhal and the Valkyriur did not exist in the earliest Scandinavian belief. Whether this were so or not, there is no doubt that the hope of an existence passed in Odin's halls stimulated the courage of roving Vikings of a later age, and was an incentive to warlike deeds; their highest virtue was valour, and this Carlyle takes to have been the soul of the whole Norse belief.

This prize of courage was in Odin's gift. Odin, of whom, little as is popularly known of the Asas (or Norse gods), every child knows somewhat; whose name is perpetuated in Wednesday, Odin's or Woden's day; "who belongs," says Max Müller, "to the same stratum of mythological thought

as Dyaus in India, Zeus in Greece, Jupiter in Italy, and who was worshipped as the supreme deity during a period long anterior to the age of the *Veda* or Homer."* Yet he has but little in common with the Zeus of the Greeks, the Jupiter of the Romans; he is altogether a much more admirable and decorous personage. Jacob Grimm says, everything points rather to his being the same as Hermes, or Mercury; but if it be permitted to differ from so great an authority, I must say that I cannot see any strong general likeness, though there are some points of agreement. Anyhow, being the supreme deity of the North and the father of gods and men, we involuntarily compare him with Zeus rather than with Hermes. Odin has many names, nearly two hundred in all, which refer to his wanderings, accomplishments and attributes, and the signification of some of these should materially assist the artist who may wish to depict him correctly; he is best known, however, by the loving title of "Alfather." He is wise, for he gave his right eye in exchange for one draught from the fountain of wisdom. He is the God of battles and victories, and Grimm tells us that precisely as in the Vedic belief "the souls of slain warriors arrive at Indra's heaven, the victory-dispensing god of our ancestors (Odin) takes up the heroes that fall in fight into his fellowship, into his army, into his heavenly dwelling,"—thus "in the North, 'faring to Odin,' 'visiting Odin,' 'being guest with Odin,' simply meant to die."

We know how the Greeks pictured Zeus, as a being of a majestic mien, with flowing beard and locks, seated thunderbolt in hand upon a golden throne, with his feet on the outstretched wings of an eagle. But the Norseman had no plastic or graphic art to give form and colour to his conceptions, nor have such broken outlines as his literature has left us been filled in for us since by painter or sculptor, or by the imagery of later writers. Still, the *Eddas* and *Sagas*

* Max Müller, *Chips from a German Workshop.*

do here and there give hints of the aspects of their heroes, and we find that, like Zeus, Odin was venerable in appearance, with a long beard and burning eye; he rides a white horse, wears a broad hat and a blue cloak (indicating that he is god of the bright sky and the air); no eagle attends him, but, instead, two ravens, Hugin and Munin (thought and memory) sit upon his shoulders and bring to his ears all that they see and hear. He wields no thunderbolt; that is the weapon of his son Thor; for Miölner, the hammer with which Thor wrought all his doughty deeds, is the thunderbolt.

In those early days, when science yet unborn could not explain away, as it sometimes does, much that is beautiful, partly because it is mysterious, men had simple explanations for nature's phenomena. They had the credulity, but also the reverence, of children; so thunder was to them not merely electricity, but, as Carlyle points out, the God Donner (thunder) or Thor. In that age men signed themselves with the sign of the hammer as now with the cross; brides and the dead were consecrated with it, and according to Grimm, "in the middle ages a stroke of lightning was long considered a happy initiatory omen to any undertaking." For Thor was regarded by men as their peculiar champion; Thor fighting battles against the frost-giants has an ethical as well as a physical meaning; is a type of that steady patient force which, rightly directed, conquers the adverse powers of nature; his belt of strength and his all-powerful hammer symbolise the energy, skill, and resolution of man, which bring the very elements under control. Every one knows that Thursday is Thor's day; and familiar as a fairy tale to many a child is the account of his sleeping at night in a mighty hall and finding it in the morning to be a giant's glove; of his adventures in Jötunheim (giant-land), where he wrestled with an old woman and was overcome because she was Old Age herself, to which all must succumb. There,

also, being challenged to a drinking combat, he was vanquished, only because the cup from which he drank was the mighty ocean; whence the ebbing of the tide was called "Thor's drinking."

Of Odin's wife, Frigg, mother of the gods, and of Frey and Freyja, the bright brother and sister, children of Njörd, god of the winds, I have not time to speak much. Freyja was the goddess of beauty and of love; from her the sixth day of the week is called Friday. She was first of all the goddesses, and shared the slain with Odin; she wore a wonderful necklace called Brasingämen, reminding one of the cestus of Venus or Aphrodite; and as Aphrodite was called "smile loving," so Freyja was said to be "fair in weeping," for she was wedded to a being named Odur, of whom no more is told than that he mysteriously disappeared; Freyja, in a car drawn by two cats, wandered all over the world in quest of him, weeping everywhere tears of gold. Frey, who was the god of sunshine and the fruits of the earth, and who ruled over the light elves, one day presumptuously placing himself on Odin's high throne, whence he could see all that passed upon earth and in Jötunheim, beheld a lovely giant maiden enter a large and beautiful house, and when she raised her arms to lift the latch, all the earth and sky glistened. Frey pined away for love of Gerda, and refused to be comforted until, by the sacrifice of his horse and magic sword, he obtained her for his wife. This is a sun-myth, rich in significance, while it seems to have none, which reminds me of the reply which a Sunday-school child once gave to a friend of my own, who, asking what was meant by a parable, and expecting the regulation answer, "An earthly story, with a heavenly meaning," was told instead, "It is a heavenly story, with no earthly meaning." So, at first sight, appears this myth; but on unfolding it we find that Gerda's marriage with Frey is the earth's turning to the

sun in summer time, and escaping the cold embrace of the frost-giant Rime; and again, Gerda in Jötunheim is thought by some to mean the seed, dormant in the ice-bound frosty earth till melted by the wooing of the sunshine. In this connection, too, it is interesting to observe how the heavenly myth gradually fades either into the heroic legend or the grotesque fairy tale. Lost for a time, it almost invariably reappears elsewhere, and under a changed aspect. This story of Frey usurping Odin's throne would seem to have originated the legend told by Grimm of the mortal man whom St. Peter admitted into heaven, and who, led by curiosity, climbed into the chair of the Lord, whence he could look down and see all that was done upon the earth. He saw a washerwoman steal two ladies' veils, whereupon he became very angry, seized the footstool of the Lord and hurled it down at the thief. "To such lengths," say Grimm, "has the ancient fable travelled!"

Throughout the *Eddas* there is distinctly foretold the doom which was to fall upon the gods when Ragnarök, their "dooms-day," should come. To ward off old age and care, they went daily to the abode of Idun, to eat from her casket her rejuvenating and wonderful apples. She was the goddess of youth and spring, wedded to Bragi, god of eloquence and poetry, whose name has descended to us with a somewhat altered signification in our word "brag," though it still means to talk much. But the apples of immortality could not prevent the trouble foretold; and Loki—the evil principle amid the good, who surpassed all others in craft, whose daughter was the dreadful Hela, whose sons were the ferocious wolf Fenris and the Midgard serpent Jörmangand—was the means of bringing it about. Loki, who is represented as "fair of face though evil of disposition," is the impersonation of mischievous, all-destroying fire; of the fire which consumes rather than warms. Stories about him fill

half the *Eddas;* his grotesque humour is a sort of redeeming quality, but he is no grand, fallen angel, like Milton's Satan, though I think we meet with him again in mediæval ideas of the devil. He is represented as friendly both with the giants and the Asas, and as for a long time the gods tolerate his misdeeds, he becomes

> "The little rift within the lute,
> Which slowly widening
> Makes the music mute,"

till his wiles bring death among the Asas, slay innocence itself in the person of the holy Balder, and so hasten the end. For this crime Loki was at length caught by the gods, and bound over three rocks, with a serpent so suspended above him that the venom should drop into his face. There was he to lie until Ragnarök. But Sigyn, his wife, stood beside him, and caught the drops in a dish; whenever it became full she went and emptied it, and meantime the poison fell upon Loki's face. Then he twisted his body so violently that the whole earth shook. "This," says the chronicler quaintly, "is what you call earthquakes."

Is not this myth quite as beautiful as the story of Prometheus, so great a favourite of poets and painters?

Balder was the second son of Odin, beloved of Asas and of men. The *Edda* says that he was "so fair of face and so bright that rays of light issued from him, and that the whitest of all plants is like unto Balder's brow; he is the wisest, mildest and most eloquent of all Asas, and such is his nature that none can alter the judgment he has pronounced." Now Balder dreamt dreams, "great and dangerous to his life," and these being interpreted to portend evil, his mother Frigga exacted an oath from fire, water, and all metals, from stones, earth, trees, sicknesses, beasts, birds, and creeping things, never to harm Balder—only she omitted the little

plant mistletoe as being too small to do anyone hurt. Thereupon the Asas, for pastime in their playground, believing Balder to be invulnerable, hurled at him stones and darts which all glanced off harmless. But Loki, in disguise, went to Frigga and learned from her that, though all other things had sworn never to hurt the sun-god, there grew "west of Valhal a little shrub mistletoe which seemed too young to extract an oath from." Armed with this fatal knowledge, jealous Loki secured the plant, rejoined the Asas, and whispering to Hödur, Balder's blind half-brother, asked why he alone stood aloof from the games. "I cannot see, and have no weapon," answered Hödur; but urged by Loki, and under his direction, he took the mistletoe and aimed at Balder, who straightway fell dead. The gods were stunned at first by the strange novelty of sorrow and death, but soon lamentations, loud and long, arose in Asgard, though Odin alone knew the extent of the evil, and that the death of Balder was the beginning of the end. There follows an account of the funeral rites, when Balder's wife Nanna broken-hearted died, and her body was laid beside his on the burning ship and pushed out to sea: one instance this among the many in Scandinavian lore of conjugal devotion. Meanwhile the God Hermode "rode nine nights through deep and dark valleys" till he reached the kingdom of Hela and implored her to send Balder back. Hela answered that if "all things quick and dead" would weep for him, he should return. (Mr. Matthew Arnold's fine poem on this subject will be quite familiar to many now present.) "Then the Asas sent messengers over all the world, praying that Balder might be wept out of Hel's power." Swiftly they sped over land and sea, from north to south, from east to west; all mankind and all nature grieved; the skies rained tears, and from the very stones came moisture, and to this day in Iceland there is a saying that when dew appears things grieve for Balder

(grata Baldr). But Thok, a giantess, believed by the *Edda* to be Loki himself, refused to grieve; she only said

> "Thok will weep
> With dry tears
> For Balder's burial;
> Neither in life nor in death
> Gave he me gladness.
> Let Hel keep what she hath!"

I have lingered rather long over this history, not only because it is the central thought and turning point in the whole tragedy of the Norse Mythology, and the most complete of the Eddaic stories, but because it is surely, in itself, one of the most beautiful of the many sun-myths. Balder, the summer sun, whose name signifies "brightness" or "whiteness," is fitly slain by his blind half-brother, winter darkness; and in the far north, where winter is indeed but one long night, the departure of summer, that is, the death of the sun, was aptly symbolised by the death of Balder, the brightest and the best beloved. But the myth seems to have deeper meaning, to point to the slaying of innocence, and thus regarded, "Balder," as Prof. Anderson says, "is no more merely the pure holy light of heaven; he is changed from a physical to an ethical myth."

No wonder then, I think, that the Christian missionaries in Iceland seized on this beautiful conception of its sun-god, adopted him, and called him "The white Christ."

A period of anarchy follows, during which "brothers fight against brothers," when "hard is the world," and "sins grow huge;" there are

> "Axe-ages, sword-ages,
> Shields are cleft in twain,
> There are wind-ages, wolf-ages,
> Ere the world falls dead."

Then dawns Ragnarök, the "doomsday," or (as other writers

interpret it), "the Twilight of the Gods;" Loki bursts his chains, the ash-tree shakes,

> "The stormy hills are dashed together, and
> Men tread the path of Hel."

The dreadful Fenris wolf gets loose; the sea rushes over the land; the heavens are rent in twain, and the fiery sons of Surt, the fire giant, come riding through the opening; they cross the rainbow bridge which leads from earth to heaven; it breaks in pieces; Heimdall, who guards the bridge, blows loudly on his horn; the gods hold council, they arm themselves, and so do the heroes; then they advance to the last great combat, and the evil and the good destroy each other. Odin attacks the Fenris wolf, which opens its gigantic jaws and swallows him; but Vidar, the silent god, rends it asunder. Thor slays the Midgard serpent, but is himself poisoned by its venomous breath; Frey rushes at Surt, but missing the magic sword which he had given for Gerda he, too, falls. Then Loki fights with Heimdall, and they kill each other. Finally—

> "The sun darkens,
> Earth in ocean sinks;
> Fall from heaven the bright stars
> Fire's breath assails
> The all-nourishing tree;
> Towering fire plays
> Against heaven itself."—
> (*The* "Vala's Prophecy," *Elder Edda.*)

But Regeneration follows Ragnarök; the earth rises again from the sea, and is green and fair; the fields unsown produce their harvest; Vale and Vidar, Hödur and Balder (night and day) return and reign over the peaceful new world; the evil principle was extinguished at Ragnarök, but the good remains.

Even from this rapid and necessarily imperfect sketch of the old Norse religion, I think it will be seen that it contains, as I said at the beginning, the germ of many a beautiful picture and noble poem. It should be observed that it was complete as a scheme; alone among the ancient beliefs of the world it taught of a birth and death of the gods; of Creation, Destruction and Regeneration, and from first to last in its literature this idea of a final end to all is kept before us. It is also complete in another sense: each separate story is one of many links in the whole chain of myths, not to be detached from the rest without some loss of meaning; whereas among the Greeks many tales might be eliminated without the mythology thereby losing symmetry. If we miss, as we certainly do, the Greek warmth of colouring, finish and grace, we miss also the Greek sensuousness; for though it is true enough that when we unfold the meaning of any Greek myth we invariably arrive at some beautiful nature-truth, yet when the same truth, or something like it, struck the imagination of the old Scandinavian, he nearly always expressed it by a story, which though often childish, grotesque, and sometimes savage, was quite free from grossness. It will be seen that they had advanced very far in nature worship, and in that apprehension of the Infinite before referred to as at the foundation of all religions. Indeed, in this respect, the untutored ancient man was far in advance of many modern ones. Such a sunset as we saw some weeks ago over our own river here, when the heavens were dyed in crimson to the zenith, and great heaped-up purple clouds settled over the horizon taking all manner of mysterious, giant-like shapes, excited less attention than a very ordinary display of fireworks. Men were talking in groups—I saw them—but of the last great cotton failure, a probable strike among the colliers, or their domestic affairs; not of the sun, for they stood with their backs to it;—and down by the water, where the ferry

boats loomed darkly and weirdly against the glory of the sky, few among the hurrying crowds crossing and recrossing seemed to give more than a passing thought to the grandeur of a sight which would have made the old heathen fall down and worship! Those who thus see with unseeing eyes can never, I venture to think, become poets or painters; but it is surprising that the old Scandinavians, with their intense susceptibility to all that was wonderful and beautiful in nature, have left no fine art behind them.

They were skilled in the working of precious metals, and much in their literature attests the value they attached to ornaments of gold and silver; they were learned in all that was connected with navigation, knowledge of the stars, winds and tides; they were excellent shipbuilders, geographers and explorers, and that they were the actual discoverers of the American continent was well shown in the interesting *Saga* of "Eric the Red," translated from the original Icelandic, and read before this Society a year or two ago by the Rev. John Sephton. The art of embroidery, of which much mention is made in the *Eddas*, was nearly allied to painting, while evidences are not wanting that they used images in their worship in groves and temples; and images, however rude, suggest the sculptor's art. But such remains of their ornament as have come down to us show it to have been absurdly conventional; there is much involution and confusion in their patterns, and their animals and figures are extremely debased in style; yet, as pointed out in the "Lectures on the Philosophy of Ornament" delivered at Liverpool University College last winter, "the union of northern decorative principles with Greek designs of figures, drapery and floral ornament, is the beginning of Gothic." *

The non-development of the Scandinavian capacity for art is, I think, partially accounted for by the condition of their

* *The Philosophy of Ornament*, by W. Gershom Collingwood.

environment. In Scandinavia they most likely expended all their superabundant energies in warlike deeds and roving adventures. Their literary spirit first woke up in Iceland; but Iceland, cold, colourless, treeless, shut out from all the world, might be "fit nurse for a poetic child" but was not the place for the fostering of a genius for the Fine Arts.

I will frankly state that my own attention was first directed to Norse Mythology as a likely field for subjects in my own branch of art. Nor was I disappointed; it does offer noble opportunities both for sculpture and painting, and it is almost untrodden ground. That the Norseman has left no monuments of art behind him, is so far an advantage that it leaves us moderns free to represent the deities and heroes of the North pretty much according to our individual imaginings. Whereas in the classic Mythology, art, aided by literature, has long invented a physical type for its leading divinities, in selecting subjects from the Norse, the artist is (within certain obvious limits) absolutely unfettered by tradition and precedent. On the other hand, it may be urged that the stories offered are mostly too indefinite, and too little known to make them acceptable as they stand, either to the artist himself or the art-loving community. Here, then, *literature* should step in; the Greek myths, when first formed, were equally colourless and vague, but the genius of Greek poetry took them up, elaborated them, and made them what they now are. For the Norse myths, Matthew Arnold has done much, William Morris still more; but more still remains to be done, so I echo Professor Anderson's hope that some day here, or on the other side of the Atlantic, a new Homer may arise, who may find in the fragments of Scandinavian Mythology, in this drama of gods and men, materials for a great Teutonic epic.

It seems to me that, "as Saxon and Norman and Dane are we," the faith held once by all Teutonic races concerns us more than any other extinct form of belief; for it tells us

what our fathers thought and felt before this England of ours was English at all. It was the light—dim enough—but still the only light, by which they lived; and for this reason, if no other, it should interest us, because, as Max Müller says, "if we will but listen attentively, we can hear in all religions a groaning of the spirit, a struggle to conceive the inconceivable, to utter the unutterable, a longing after the Infinite, a love of God."

JANE, QUEEN OF ENGLAND: HER LIFE AND TIMES.

By JOSIAH MARPLES.

To-night the noblest subject swells our scene,
A heroine, a martyr, and a queen:
And though the poet dares not boast his art,
The very theme shall something great impart.

. . . .

Oh! could our author's pencil justly paint
Such as she was in life, the beauteous saint,
Boldly your strict attention might we claim.*

In such terms speaks one of our old writers, and the subject on which he is so enthusiastic is one so little known that probably it is unnecessary to offer any apology for bringing before the Society such particulars of the life and times of Queen Jane, or Lady Jane Grey, as she is usually termed, as have come under notice during my readings in the history of the Sixteenth Century.

In order to a right understanding of the position occupied by the subject of the paper, it will be needful that we take a glance at the state of affairs in the country for a few years previous to the death of Edward VI, to whom Queen Jane succeeded. This view will show what will probably be admitted to be a very curious state of affairs, viz., that though there was, at the death of Edward, an almost endless list of women who could, one after another, claim the throne, the only male heir was Edward Courtenay, Earl of

* *Prologue to "Lady Jane Gray:" a Tragedy*, by N. Rowe. Bell's *British Theatre*, 1797, vol. xv.

Devonshire, whose right was through his descent from Edward IV.

This will probably be the most suitable opportunity to examine the genealogical table before us, and to make some comments upon the lists of ladies referred to in it, that we may see exactly how they were connected with the Royal family, and what their claims were.

Genealogical Table

Showing the descent of the Heiresses to the Crown, with their ages at the death of Edward VI, in 1553.

Henry VII had issue—

- Henry VIII.
  - Mary, aged 38.
  - Elizabeth, aged 20.
  - Edward VI, d. aged 16.
- Margaret, Q. of Scots.
  - James V.
    - Mary, Q. of Scots, aged 11.
  - Margaret, C. of Lennox, aged 38.
    - H. Darnley, K. of Scot.
- Mary, Q. of France, m. secondly Charles Brandon, D. of Suffolk.
  - Frances, Duchess of Suffolk, aged 36.
    - Jane, aged 17.
    - Katherine.
    - Mary.
  - Eleanor, d. 1547.
    - Margaret, aged 18.

It will be seen that Henry VII, besides Arthur, Prince of Wales, who died at the age of 16, and some other children who died in infancy, had one son, Henry VIII, and two daughters, Margaret and Mary.

The eldest of these, Margaret, was married to James IV, King of Scotland. Our principal interest in her arises from the fact that, though she was left out of the question entirely in all arrangements for the succession, her granddaughter Mary, Queen of Scots, exercised considerable influence on

our history, and her great-grandson, James VI, became the first King of Great Britain. At the time of the arrangement of the treaty for the marriage of Margaret to James, the question was put in the Scottish Council, supposing that the sons of Henry VII died without issue, would not the marriage of the Scottish King to the elder daughter be awkward for England? "where unto," says Bacon, "the King himself replied, that if that should be, Scotland would be but an accession to England, and not England to Scotland, for that the greater would draw the less," * a reply which was but a prophecy of what did occur, in spite of all the wills and schemes disposing of the crown without reference to Margaret. It will be seen that by her second husband, the Earl of Angus, Margaret was the grandmother of Darnley, the second husband of Mary, Queen of Scots, the father of James VI. Her second son by the same husband was Charles Stuart, Duke of Lennox, who, during the imprisonment of his cousin Mary Stuart in England, married Elizabeth Cavendish, daughter of Bess of Hardwick, and stepdaughter of the Earl of Shrewsbury, in whose charge Mary was at the time. Lady Lennox, who was Mary's mother-in-law, and who was much incensed against her as the supposed murderer of her son, Lord Darnley, had been on a visit to Queen Elizabeth, who had thought it desirable to caution her not to call at Chatsworth, Mary's place of confinement, on her way back. The Countess of Shrewsbury, however, with a keen eye to the advancement of her family, in which she was one of the cleverest women of the day, thought the opportunity too good to be lost, so she met Lady Lennox and her son near Rufford Abbey, one of her seats near Newark, and invited them to rest. Lady Lennox being weary and sick, and Lady Shrewsbury very pressing, she consented and rested five days, confined to her

* Bacon's *History of King Henry VII.*

room almost the whole time, but attended assiduously by Lady Shrewsbury, who thought this the best way to leave the young people together. The result was as might have been expected, Earl Shrewsbury's letter on the occasion to Burghley saying, "The young man, her son, fell into liking with my wife's daughter, before intended . . . and such liking was between them as my wife tells me she makes no doubt of a match, and hath so tied themselves, upon their own liking as . . . cannot part. . . . The young man is so far in love, that belike he is sick without her." *

The issue of this marriage, which gave great offence to Elizabeth, was the ill-fated Arabella Stuart, whose rank was a sore burden to her all her life. Soon after the accession of her cousin, James I, a plot in her favour was formed, said to have been conducted chiefly by Sir Walter Raleigh—though this is not by any means certain. In 1609, when 33 years old, Arabella secretly married William Seymour, son of Lord Beauchamp. He was sent to the Tower for marrying with one of the royal blood without consent of the King, and his wife was placed in charge of a keeper at Highgate. She fled disguised in man's attire, by arrangement with her husband, who was to meet her and escape to France; he missed the ship, which sailed without him, only to be captured by an English vessel sent for the purpose, and she was committed to the Tower, where she died in 1615. Her husband then obtained pardon, and, fighting for Charles I, was raised to the dukedom of Somerset.

Mary, second sister of Henry VIII, in whom we have more interest, as she was the grandmother of Jane, the subject of our paper, was married first to the King of France, Louis XII. He was at the time an elderly *debauchée*, and it was much against her will that Mary, then only in her sixteenth year, consented to marry him. Her affections at the

* Shrewsbury to Burghley, Nov. 5. *Cotton. MSS.*

time were set upon another, namely, Sir Charles Brandon, who first appears in history as the captain of the "Sovereign," one of the ships fitted out to make a descent upon the coast of France in 1512. He displayed great bravery there, so much so, that the following year he was appointed to command the vanguard of the army, and created Viscount Lisle. He was present at the "Battle of Spurs," so named by the French in acknowledgment of the only weapons they used that day, in which, besides Sir Charles, the King had for company three knights, Sir Thomas Boleyn, Sir Thomas Seymour, and Sir Thomas Parr, each of whom became successively his father-in-law. In 1513, Sir Charles was created Duke of Suffolk. In 1546, he was first to plant the Royal Standard of England on the walls of Boulogne. His father, Sir William Brandon, had been standard-bearer to the Earl of Richmond, and had lost his life at the hands of Richard III himself in the fatal charge at Bosworth Field, which cost Richard his life, placed the crown on the head of Henry VII, and brought to an end the line of Plantagenet Kings of England and the sanguinary Wars of the Roses. Sir Charles was one of the handsomest men of the time, and, having been educated with the King, he was accomplished even for the court of that time, and he was certainly both physically and morally a much more suitable alliance for the beautiful Princess; but reasons of state stepped in, and Mary was induced to become the wife of Louis, one, possibly, of the most potent arguments being the promise of her brother Henry, that if she married to please him this time she should please herself if another occasion offered. Henry knew of the mutual attachment of Mary and Brandon, and there can be no doubt he sanctioned it, for he appointed him to be ambassador to Paris that he might watch over her. Mary's release came sooner than she could have hoped for, Louis dying within three months after the ill-assorted

marriage; but during that time she seems to have won the respect of all around her. The new king, Francis, soon found out her inclinations, and encouraged her in every way he could, but both Mary and Brandon had promised Henry they would take no steps without his consent, and this they set to work to obtain. The difficulties raised by Henry do not redound to his credit, as they were simply of a mean, penurious kind. He insisted that all the jewels settled on Mary before her marriage, and those given and promised to his young wife by Louis—who would not give them all to her on her marriage, for he said, "I wish to have many and at divers times kisses and thanks for them"—should be sent to him, and he entrusted Brandon with the task of obtaining them, with the promise of the hand of Mary if he succeeded. The French insisted that they were only given to Mary as Queen of France, and while they were quite at her disposal in that capacity, she could not take them out of the country with her. Much unseemly haggling took place, Brandon, with true gentlemanly instincts, being heartily ashamed of his portion in it. In vain Mary wrote reminding her brother of his promise, and offering to give him all the plate and jewels she had, and even to restore to him all the dowry he gave her and a portion of the jointure settled upon her by the French King at her marriage. At last she became tired of waiting, and told her lover that if he did not marry her within four days he should never have her at all; so Brandon took courage, called King Francis to his aid, and the marriage took place secretly in the chapel of the Palace of Clugny, in which Mary lived. The couple at once wrote and told Henry what they had done, and justified it in the best way they could, Mary saying it was all her doing, and Brandon accepting that version, rather meanly, and appealing to Henry's avarice by offering to "give your grace what sum you shall be content to axe, to be paid on her

jointure." Mary wrote a most eloquent letter, in which, instead of taking the high position she might fairly have done, and claiming the right to dispose of her hand and person to whom she pleased, she earnestly seeks pardon for her wrong-doing, and asks for permission to make her marriage known. Brandon's enemies, in the meantime, were doing all they could to undermine his influence at court, and Henry would send no reply till Brandon had fulfilled his mission. Matters were, however, so progressing in Paris that the marriage could not be kept secret much longer, and already gossips were talking about the constant presence of the handsome ambassador at the palace of *La Reine Blanche*, as the widow of the late king was called. At last, in answer to urgent letters, Henry gave them permission to return to England. In fear and trembling they came, and after submitting to a hard bargain they bought their pardon, and were publicly married at Greenwich, the fact of the previous private marriage being kept a strict state secret. Brandon understood Henry's character well, and never presumed upon his connection, and it is said he embroidered on his pennon the following lines, indicative equally of his good taste and his good sense:—

> "Cloth of gold, do not despise,
> Though thou be matched with cloth of frize;
> Cloth of frize, be not too bold,
> Though thou be matched with cloth of gold." *

His life prior to his marriage to Mary was not irreproachable, for he had in early life engaged himself to a girl of low degree, Ann Brown, an engagement which he repudiated in order to marry Lady Margaret Mortymer, his own cousin. Tired of her, he had the marriage dissolved on account of their being within the prohibited degrees of consanguinity,

* Granger's *Biog. Hist.*, i, 82.

and returned to his first love, whom he discarded a second time for the brilliant match of which we have spoken. He lived happily with Mary, however, and we find that thirteen years later he applied to the Pope and obtained a "bull" to invalidate his earlier marriages, and pronounce that with Mary legal and its offspring legitimate. It is stated that Mary was the most beautiful woman in the kingdom, in proof of which it is reported that, when the Emperor Charles V, to whom Henry VII had in her childhood betrothed her by the last act of state which he performed before his death, paid a visit to England in 1520, he was so struck by her beauty that, remembering the treaty referred to, he experienced so much vexation that he took little delight in the splendid festivities prepared for him. The issue of this marriage was two daughters, Frances, the elder, being the mother of the three ladies next in the succession, Jane, Katherine, and Mary Grey; and the other, Eleanor, who died in 1547, leaving one daughter, Margaret, who is the last in our list. She was married with the sanction of the Queen, in 1555, to Henry Lord Strange, afterwards Earl of Derby. The fate of these ladies is not edifying. Katherine married the Earl of Hertford, in 1561, without permission of the Queen; she died a state prisoner. Mary demeaned herself, in 1565, by a secret marriage with the Queen's sergeant-porter, and was kept a prisoner till the death of her husband in 1571; she died childless in 1578—one chronicler states she was somewhat deformed. The last in our list, Margaret, having outlived all the rest, became in her turn the object of Elizabeth's jealousy,* and, on pretence of having "practised against her life by magic," she was arrested about 1580, and languished in prison for several years, her sole offence being that she represented the house of Suffolk, and, with Arabella Stuart, was one of the heiresses

* Miss Strickland's *Queens of England*, iv., 560.

to the throne in case of the death of James VI of Scotland childless.

It is now time for us to return to Henry VIII, whose three children came to the throne. As he had divorced the mothers of his two daughters, and his parliament had declared their issue illegitimate, and had only one son, the succession had been a matter of considerable anxiety to him. On the birth of Elizabeth, he induced the parliament to pass an Act giving him full and plenary powers to give, dispose, etc., of the crown, either by letters patent or by will. He had hoped for a son, in which case nothing would have been needed beyond the application of the ordinary rules of succession, but the presence of an older daughter, Mary, who had been declared illegitimate, rendered it necessary that some arrangement should be made which would, if possible, prevent civil war after his death. The first scheme he propounded after his marriage to Jane Seymour, the mother of Edward VI; but seven years later, probably foreseeing the early death of his only son, he made a will, by which the crown was to devolve: (1), on his son, Edward, and the heirs of his body; (2), on his own heirs male by Katherine Parr, or any future wife; (3), on his daughter Mary; (4), on his daughter Elizabeth; (5), on the heirs of the body of his niece, Lady Frances; (6), on those of her sister, Lady Eleanor; and (7), to the next rightful heirs. This seems a perfectly reasonable scheme, and its only fault is that it places the disposal of the crown as a personal prerogative of the reigning monarch, a dangerous precedent, and one the following of which led to much mischief. It will be observed that this scheme ignores Margaret entirely. At the King's death, Edward VI, his only son, ascended the throne, but as he was only ten years old he was taken charge of by his mother's relatives, of whom the council named by the late king's will was chiefly composed, and his uncle, afterwards

Duke of Somerset, obtained from his colleagues the title of Protector of the Kingdom and Governor of the King's person. His brother, Lord Seymour, in the month following that in which Henry died, made a proposal for the hand of the Princess Elizabeth, and, on her refusal, at once transferred his affections to her step-mother, the widow of the lately deceased King, who accepted him, and one month later he was secretly married to her. Though only thirty-five years of age, Katherine Parr had already buried three husbands,* so that in his matrimonial venture the Lord High Admiral gave evidence of the possession of no little of that courage which has been considered the birthright of an English sailor.

It must be borne in mind that Mary and Elizabeth still remained under the ban of illegitimacy, the Acts of Parliament declaring them to be so not having been repealed; and if Edward chose to follow the evil example of his father, it was competent for him to make a will, by which he could devise the crown; and if he further followed the same example, and left the crown as he did, simply omitting his two half-sisters, on the ground of their illegitimacy, Jane, the eldest daughter of the Marquis of Dorset and Frances, niece of Henry VIII, was early in the succession, and whoever married her stood a good chance of attaining royal rank. This was so evident that at one time there was a proposal to marry Jane to her cousin, the young King; † this was part of a scheme of Lord Seymour to supplant his brother, the Protector, and had it succeeded, he then—his wife, the lively widow, having died within twelve months of her marriage—proposed to solace himself with the hand of Elizabeth, whom

* Katherine was married in 1527 to Lord Borough, who died two years afterwards; she next married John Neville, Lord Latimer, an old man, who died in 1543; and then she married King Henry VIII, in the same year, to become a widow for the third time in 1547.

† Weisener's *Youth of Queen Elizabeth*, i, 40.

he looked upon as next heir to Edward; and there is reason to believe that the marriage would have been an acceptable one to Elizabeth, for she is reported to have been strongly attached to him. As "no scandal about Queen Elizabeth" is allowed, we will say no more. Unfortunately for this fine plan, the Protector got to hear of it, and promptly ended it by cutting off the head of his brother. All this scheming, however, shewed how important it was to have the succession settled, for it had become evident that the King would not live long, signs of consumption having already shewn themselves. Somerset had been almost sole ruler of the country since his appointment as Protector, and he had exercised his power in such a way as to make himself enemies—amongst them John Dudley, Viscount Lisle, whom Somerset had created Earl of Warwick and Grand Chamberlain, in recompense of his support on the accession of Edward. Compelled to resign his post of Lord High Admiral for the benefit of Lord Seymour, he had begrudged the loss of the office so much that he ever afterwards endeavoured to sow dissension in the family of the Seymours. In 1549 he had been sent to suppress what was called "Kett's Rising," in Norfolk, and he obtained much credit by his success in that mission. It was in this expedition that his son, Robert Dudley, met at Stanfield Hall with Amy Robsart, to whom he was married in the following year. Somerset, on the contrary, in consequence of the reverses sustained by the troops, both in Scotland and on the Continent, had fallen greatly in popularity; and in October he was deposed from his position and sent to the Tower, which he only left in January, 1550, after consenting to the surrender of all his offices, all his personal property, and much of his land. Warwick now seized the reins of power. In October, 1551, he created himself Duke of Northumberland, extinct since the attainder of the Percies, fourteen years previously; and he raised to

the dukedom of Suffolk, Henry Grey, Marquis of Dorset, whose wife was Duchess of Suffolk in her own right, and through whose eldest daughter, Jane Grey, he hoped to realise his ambitious projects. Northumberland had four sons, three of whom were married; but the youngest, Guildford, was still available, and in May, 1553, he was married to Jane. It was quite time, for the King's illness was becoming more and more apparent, and his Council, at the instigation of Northumberland, pressed upon him the necessity of making a will to regulate the succession. The power to do this had been granted to Henry VIII by Parliament, but no such power was asked by Edward, who with his own hand wrote out a scheme, which he called, "My Devise for the Succession." The first paragraph of this is as follows, rendered into modern English:—"For lack of male issue of my body, to the male issue coming of females as hereafter declared. To the Lady Frances's heirs male,—for lack of such issue, to the Lady Jane and her heirs male; to the Lady Katherine's heirs male; to the Lady Mary's heirs male, to the heirs male of the daughters which she (Lady Frances) shall have hereafter. Then to the Lady Margaret's heirs male, for lack of such issue to the heirs male of Lady Jane's daughters, then of Lady Katherine's daughter, and so on till you come to Lady Margaret's daughter's heirs male."

It will be noticed that there is a very remarkable peculiarity in this, that while in every instance the "heirs male" are to inherit, in the case of Lady Jane it is "Lady Jane and her heirs male"; this was an alteration from the original draft, which stood, "Lady Jane's heirs male," and in the formal Letters Patent, which were afterwards drawn up, for which this draft formed the basis, a similar alteration was made in the case of each of her sisters in order to give some show of consistency. The Letters Patent were apparently duly signed on June 21st, 1553, by all the Great

Officers of State, the Judges, Archbishops, Bishops, and many others; and they were further confirmed by an "engagement of the Council and others to maintain the succession as limited by the King," which had been entered into previously. So far, Northumberland's scheme had succeeded; he had married his son to Lady Jane Grey, and then he had, as he supposed, secured the succession to the throne—a succession which could not long be delayed—to his son's wife, by Letters Patent, which were so far fair in themselves that, granting the ineligibility of Mary and Elizabeth, they would probably have been carried out.

Lady Jane Grey herself was worthy of all the honours which could be bestowed upon her, and she stands out as the one female character of historical note of the period of whom slander has not an ill word to say. In her different capacities of daughter, wife, queen, and martyr, she stands a bright and unique example of all that was lovely and of good report.

Jane was born at Bradgate, the seat of her father, about four miles from Leicester, in 1537. The exact day of her birth is unknown, the destruction of monastic and church records having taken away almost the only evidence of the fact. The ruins of Bradgate, extant till recently, shew it to have been what we should call an Elizabethan house of red brick. It was built by the grandfather of Jane as a hunting lodge, in consequence of the ruinous state of Groby Castle, which it was not thought desirable to rebuild, the site being damp. Having been built more for defensive purposes than for a family dwelling, it was considered unsuitable for a residence at that time, as the gradually improved and quieter state of the county pointed to the erection of houses of a more commodious and convenient plan. It was surrounded by a large park of about six miles, and a forest of twenty miles in circumference. Not far from it was the mansion of Beaumanoir, a favourite country seat of Henry VIII.

The Marquis of Dorset and his wife were strict disciplinarians, and their children had what we should consider a hard time of it. The very early promise of genius and intellect which their eldest daughter gave induced them to afford her every facility for an education superior to what was then common, and one result was, that even greater severity than usual was exhibited towards her. Jane, however, throve upon it, and soon became mistress of all the learning that her tutors could impart to her. In an elegy upon her, published soon after her death, Sir Thomas Chaloner speaks not only of her wonderful gift of conversation, but of her stupendous skill in languages, of which she was well versed in eight—Latin, Greek, Hebrew, Chaldaic, Arabic, French, and Italian, besides her mother tongue. She was also an excellent instrumental musician, wrote well, and was clever at her needle; we may add that, in the specimens preserved to us of her letters, her spelling is much less erratic than that of her contemporaries, a fact for which we should not blame them when it is borne in mind that there was not during her lifetime a dictionary of our language. The tutor to whom much of this learning was due was John Aylmer, a Protestant clergyman, who, by his refusal to follow Henry VIII in his numerous changes of ritual, gave so much offence that it was desirable for him to remain in the solitude of the country, and it is said that he so firmly fixed the Protestant religion in Leicestershire that neither force nor fraud could blot it out. Roger Ascham, who is so well known to us as the tutor of Elizabeth, was a neighbour, and he taught writing to our heroine, who frequently corresponded with him. Early in Jane's life, certainly before she was nine years old, she was appointed to some office at the court of Katherine Parr, the last wife of Henry VIII, and it is said she was frequently held up as a model for imitation to the young heir apparent, Edward. Elizabeth is also spoken of as visiting the Greys

at their house at Westminster; but Mary was during all this time in disgrace, and was not allowed to come near London. This constant visiting and waiting at court had not the evil effect that might have been anticipated, for Katherine was a very sedate and good mistress, and her orderly establishment, even when Queen Dowager, was almost equal to a royal court, while she was herself a very learned woman. Jane seems to have lived almost entirely with the Queen till her death, in 1548. Even then, though she was only eleven years old, her hand was already sought for. The Duke of Somerset wanted it for his son, Lord Hertford (who afterwards married her sister). Lord Sudeley, however, Somerset's brother, had other views, and opposed this; it will be remembered that his scheme was to marry Jane to her cousin, the King, and so to remove her from any chance of the succession in the event of the King's death, in which case he wished to be near the direct line as the husband of Elizabeth. In 1549, Sudeley was beheaded, prior to which time, however, Jane had returned to Bradgate, and in August, 1550, Roger Ascham, about to set out on a diplomatic mission to Germany, went down to visit his friends, particularly Lady Jane, to whom he states he was under special obligations. On his arrival at Bradgate, he found all the family out hunting, except Jane, who was discovered in her chamber, reading the *Phaedon* of Plato in Greek; in reply to his remarks, she said, smiling, "I wisse all their sport in the park is but a shadow to that pleasure that I find in Plato. Alas! guid folk, they never felt what true pleasure means." In 1551, she received a long letter in Latin from Ascham, who was still away, reminding her of his last conversation with her, and asking her to write to him in Greek as she had agreed to do, saying that he had promised some learned men a sight of the letter. One paragraph in his letter deserves quotation: "Thy kindness to me, oh most noble Jane Grey, was always most grateful to

me when present with you; but it is ten times more so during this long absence. To your noble parents, I wish length of happiness; to you, a daily victory in letters and in virtue; to thy sister Katherine, that she may resemble thee; and to Elmer (or Aylmer, her tutor), I wish every good that he may wish to Ascham." Later on, in the same year, she wrote in Latin to one of the leaders of the Reformation at Zurich, Henry Bullinger, and in her letter she mentions that she is studying Hebrew. In October, 1551, her father, on being raised to the rank of his wife and made Duke of Suffolk, came to London, where in November Jane appeared at the reception of Mary of Lorraine, then on her way to visit the kingdom of her daughter, Mary Stuart. Early in 1552, she wrote a second letter to Bullinger, who had written to ask for a scholarship in King's College, Cambridge, for a friend of his; and about this time is seen the commencement of the intrigues which were to end so disastrously for Jane and all her friends—intrigues the development of which will next occupy our attention.

King Edward VI died at Greenwich, "towards night," on the 6th July, 1553, and at two o'clock the following morning the Marquis of Northampton, the Marquis of Winchester, lord treasurer, the Earl of Shrewsbury, and Lord Clinton, lord admiral, went to the tower, of which they took possession, appointing Lord Clinton constable on behalf of the Queen. The King's death was kept strictly secret, so far as it could be, until Northumberland's arrangements were complete. These included the possession and safe custody of Mary, who was therefore invited to London to see her brother. She set out at once from Hunsdon, but when she had proceeded but a few miles on her way she was met by a messenger, who told her the King was dead and that it was intended to commit her to the Tower. She turned her horses' heads towards Cambridgeshire, hoping through Bury St.

Edmunds to reach Kenninghall. Late at night they reached Sawston Hall, near Cambridge, where they craved rest and refreshment from Mr. Huddleston, the owner, through a relative of the same name, who was one of Mary's attendants. Early the next morning they learned that the Protestant townsmen of Cambridge, hearing of her presence, had determined to take her prisoner, and the fugitives set out in various disguises, it being said that Mary rode behind Mr. Huddleston disguised as a market-woman. On reaching a neighbouring hill, Mary turned round and looked back, when she saw the devoted house which she had just left burst into flames, the mob from Cambridge having fired it when they found their prey had escaped. Had they followed her, instead of staying to burn and pillage the house, the course of history might have been changed, so close were they behind her. When she saw the house burning, she said, "Let it blaze, I will build Huddleston a better," and she kept her word. It is recorded that she rode forty miles that day and reached Kenninghall. On the 11th, three days later, she removed further to Framlingham, a better position for defence and much nearer the coast, so that if she were compelled to retreat she could escape to Flanders to her uncle, Charles V, King of Spain.

On the 8th of July, the Lord Mayor of London was sent for to Greenwich, with some aldermen, merchants and others, to whom the death of the King was made known and the letters patent shewn providing for the succession; they were sworn to secrecy about this, and then departed. Meantime, the Dukes of Northumberland and Suffolk waited upon Jane and tendered her the crown. She was at her father's house at Sheen, near Richmond, and was much shocked at the news of the death of her cousin. Her scruples against accepting the crown were very strong, and it was only after much argument, and almost force, that she was induced

to place herself at the disposal of her father and father-in-law, by whom she was taken down the river in a barge to the Tower, and there received as Queen, about three o'clock. Two hours later, proclamation was made of the death of the King, and that he had devised the crown to Lady Jane. On the 12th, word was brought that Mary was at Kenninghall Castle, in Norfolk, and that her friends were gathering round her, whereupon the Council decided that the Duke of Suffolk should at once go to bring her up to London. The tears of the Queen, however, who naturally disliked to be deprived of the presence and support of her father, caused a change in the arrangement, and the Duke of Northumberland was sent instead, it being thought that the fear which his name would inspire in the county would help their cause, as he had been so successful in putting down "Kett's Rising." The scene at parting was a painful one, for though Northumberland left in apparent certainty of a speedy and happy termination of his mission, he was evidently doubtful of those he left behind. He took about six hundred men, but he remarked that, as they passed Shoreditch, "the people prece to see us, but not one sayeth God spede us." * On the 12th, Mary sent a request to Norwich that she should be proclaimed Queen, but in the absence of official intimation of the King's death the request was not complied with till the following day. Few of the towns proclaimed Jane, Berwick-on-Tweed being one; and Lord Robert Dudley (her brother-in-law, and husband to Amy Robsart) proclaimed her at King's Lynn, near which his wife's property was situated. It would appear, in fact, that the people through the country at once declared for Mary, and by the 18th, five days after his leaving London, the Duke, finding he received no support, retired to Cambridge; the following day he heard that Mary had been proclaimed in London, and he himself then

* *Chronicle of Queen Jane*, Camden Soc. Pub., p. 8.

proclaimed her in Cambridge. His repentance, however, did not avail him much, for he was arrested. The same night came word from the Council that the little army should disperse, and "go eche his waye." On this they were all set at liberty; but, the following morning, when the Earl of Warwick was prepared to ride to London, the Earl of Arundel came and re-arrested the chiefs, in the name of the Queen. In the meantime, the scene in London was much more exciting, for we learn from a newsletter of the time that, on the 19th of July, "my lady Marye's grace was in the afternoone proclaymed queene of England heare in Londone. . . . . Great was the triumphe, for my tyme I never sawe the lyke, and by report of others the lyke was never seene. The nomber of cappes that weare throwne upe at the proclamation weare not to be tould. . . . The bonefires weare without nomber, and what with showtynge and crienge of the people, and ringinge of the belles, theare could no one heare almoste what another sayd, besides banketyngs, and synging in the streete for joye." This proclamation was made by a portion of the Council, headed by the Earl of Arundel, who had left the Tower, where Queen Jane was holding her Court, under pretext of giving audience to the French ambassador at Barnard's Castle. The news of this treachery and of the reception of the proclamation of Mary soon reached the Tower, and spread dismay through the slender ranks of Jane's friends, and *sauve qui peut* became the order of the day. Her father, the Duke of Suffolk, was at the Tower, and, it is believed, did not know of the intention to proclaim Mary, "but so soone as he herd of it he came himselfe out of the Tower, and commanded his men to leave their wepones behinde them, sayenge that hee himselfe was but one man, and himselfe proclaymed my lady Maryes Grace Queene on the Towere Hille, and so came into London, levinge the leiftenaunt in the Towere." We soon

read that on the 23rd instant, thirteen days after the proclamation of Jane, the Duke of Northumberland was in prison at Cambridge, while the Duchess, with Lord Guildford and the Lady Jane, were prisoners in that Tower which had so recently served the latter as a palace.

Mary, meantime, was making her way slowly towards the capital. On the 29th we read that Elizabeth came to Somerset Place, in order to go to meet her sister, who made her state entry on the 3rd August, amidst great rejoicings. On the 18th August, the Duke of Northumberland, his son the Earl of Warwick, and the Marquis of Northampton were arraigned for high treason at Westminster Hall. The Duke put the two following questions to the judges: first, whether a man acting under the authority of the Prince's Council, and with the warrant of the Great Seal of the country, could be charged for treason for any acts he might do under such warrant; and secondly, whether, if he were so guilty, other members of the Council who had been equally guilty with him, and by whose letters and instruction he had acted, could be his judges? The answers to these questions were: first, that the seal was not the seal of the Queen, but of an usurper, and hence of no value; and secondly, that if there were no writs of attainder on record against any other of the lords they could sit in judgment upon him. The Duke at once confessed his crime and received sentence. He then asked that the court would request the Queen to grant him four things—first, that the death he should suffer should be that which noblemen had suffered before; second, that Her Majesty would be gracious to his children, who might do her good service in after years, remembering that they had acted by his command and not of their own free will; thirdly, that he might have some learned man for his instruction; and lastly, that two of the Council might attend upon him, to whom he would declare such matters as the

Government of the Queen should know. His eldest son, the Earl of Warwick, was condemned at the same time. The following day another company of four were arraigned and condemned, amongst them Sir Andrew Dudley, a brother of the duke. Two days later the execution was fixed; but instead, an altar was erected, and all the condemned, possibly in the hope of pardon, recanted their religion and assisted at mass. The following day the Duke and two others were beheaded. A week later a most interesting conversation took place in the house of one Partridge, in the Tower, with whom Lady Jane was living, and, as it has escaped the notice of most of her biographers, no apology is needed for its record here. After dinner, at which the diarist was present and sat at table, he writes: "Saithe she, 'The Quene's Majesty is a mercyful Princes, I beseche God she may long contynue, and sende his bountefull grace apon hir.' After that we fell in (discourse of) mattiers of religion; and she axed what he was that preched at Polles on Sonday beefore; and so it was told hir to be one (*blank in* M.S.). 'I praie you,' quod she, 'have they masse in London?' 'Yay, for suthe,' quod I, 'in some places.' 'Yt may so be,' quod she, 'yt is not so strange as the sodden convertyon of the late duke; for who wolde have thought,' saide she, 'he would have so don?' Yt was answered her, 'Perchance he thereby hoped to have had his pardon.' 'Pardon!' quod she, 'wo worthe him! he hathe brought me and our stocke in most myserable callamyty and mysery by his exceeding ambicion. But for th' aunswering that he hoped for life by his tourning, thoughe other men be of that opynion, I utterly am not; for what man is ther lyving, I pray you, although he had been innocent, that wolde hope of life in that case; being in the felde against the quene in person as generall, ... who was judge that he shoulde hope for pardon, whose life

was odyous to all men? But what will ye more? like as his life was wicked and full of dissimulacion, so was his ende thereafter. I pray God, I, nor no frende of myne, dye so. Shoulde I, who am yonge, and in the fervour of my yeers, forsake my faythe for the love of lyfe? Nay, God forbid! moche more he should not, whose fatall course, althoughe he had lyved his just noumber of yeres, coulde not have long contynued. But lyfe was swete, it appeared; so he might have lyved, you will say, he dyd not care how. . . . . But God be mercyful to us, for he sayeth, whoso denyeth him before men, he will not know him in his Father's Kingdom.' "

Jane remained untried in the Tower from July to November, on the 18th of which month a procession was formed from the Tower to the Guildhall, the fatal axe leading the way, with its edge, however, turned from the prisoners. Thomas Cranmer, Archbishop of Canterbury, was a worthy leader, next Lord Guildford Dudley, then Lady Jane with her two gentlewomen, followed by Lord Ambrose Dudley and Lord Henry Dudley.

We are told that "Lady Jane was in a blacke gowne of cloth, tourned down, the cappe lyned with fese velvett, and edget about with the same, in a French hoode, all black, with a black byllyment, a black velvet boke hanging before hir, and another boke in hir hande open." Of course they were all sentenced to death, but we learn from the industrious chronicler, to whom we are indebted for most of these personal notes, that on the 18th December "Lady Jane had the libertie of the Tower, so that she might walk in the Quene's garden and on the hille; and the lorde Robert and lorde Gilford the liberty of the leds in the Bell Tower." Lord Robert was not arraigned till the 23rd of January, when he was condemned.

About November began the earliest gossip as to the

proposal for the marriage of Mary to the King of Spain, an arrangement much disliked by the people, who feared that it would result in England's becoming an appanage to the crown of Spain, a fate not at all improbable had there been issue of the marriage. The agitation against this match increased till the end of January, and it found vent in Wyatt's Rebellion, when the men of Kent rose, and nearly succeeded in taking the Tower. The Duke of Suffolk and his two brothers, Lords John and Leonard Grey, fled, and by so doing gave countenance to the opinion that they sympathised with, if they did not actually assist in, the rebellion. Into the interesting details of this rising, which are before us, and in which Ainsworth found the material for his powerful romance of *The Tower of London*, we have not time to enter, but it was necessary that it should be mentioned, as it was to it that Lady Jane and her husband owed their deaths. By the 8th February, Wyatt and his fellow leaders were lodged in the Tower, and two days later the Duke of Suffolk and his brother were brought in.

On Sunday, the 11th February, Gardiner, Bishop of Winchester, preached at the Chapel Royal before Queen Mary, and at the end of the sermon he asked a boon from her, namely, that as she had extended her mercy to those who had risen against her, so now it was her duty to her faithful subjects that she should cut off and consume the hurtful members. "And thus he ended soone after; wherby all the audyence dyd gather ther should shortly followe sharpe and cruell execution." The anticipation was realised, for about ten o'clock the following morning Lord Guildford Dudley was taken to the scaffold on Tower Hill. He refused to recant, and declined to have a priest, and after praying and desiring those around to pray for him he laid his head on the block, and at one stroke it was cut off.

Our diarist continues: "His carcas throwne into a carre, and his hed in a cloth, he was brought into the chappell within the Tower, where the Ladye Jane, whose lodging was in Partrige's house, dyd see his ded carcase taken out of the cart, as well as she dyd see him before on lyve going to his deathe, a sight to hir no lesse then deathe." Meantime another scaffold was being erected on Tower Green, within the precincts, upon which Lady Jane herself was to atone for the unlawful ambition of those who should have cherished and protected her. We cannot do better here than quote the words of the contemporary writer from whom we have borrowed so much. He seems to have written with a sympathy and love for the noble victim which was excited in all who knew her.

"The saide lady, being nothing at all abashed, neither with feare of her owne deathe, which then approached, neither with the sight of the ded carcase of hir husbande, when he was brought in to the chappell, came fourthe, the levetenaunt leding hir, in the same gown wherein she was arrayned, hir countenance nothing abashed, neither her eyes enything moysted with teares, although her ij gentylwomen, mistress Elizabeth Tylney and mistress Eleyn, wonderfully wept, with a boke in hir hande, wheron she praied all the way till she cam to the saide scaffolde, wheron when she was mounted, she sayd to the people standing thereabout: 'Good people, I am come hither to die, and by a lawe I am condemned to the same. The fact, in dede, against the quene's highnesse was unlawfull, and the consenting thereunto by me: but touching the procurement and desyre therof by me or on my halfe, I doo wash my handes therof in innocencie, before God, and the face of you, good Christian people, this day,' and therewith she wrong her handes, in which she had hir booke. Then she sayd, 'I pray you all, good Christian people, to beare me witnesse that

I dye a true Christian woman, and that I looke to be saved by none other meane, but only by the mercy of God, in the merites of the blood of his only sonne Jesus Christ: and I confesse, when I dyd know the word of God, I neglected the same, loved my selfe and the world, and therefore this plague or punyshment is happely and worthely happened unto me for my sins; and yet I thank God of his goodnesse that he hath thus geven me a tyme and respet to repent. And now, good people, while I am alyve, I pray you to assyst me with your prayers.' And then knelyng downe, she turned to Fecknam, saying, 'Shall I say this psalme?' And he said, 'Yea.' Then she said the psalme of *Miserere mei Deus* in English, in most devout maner, to the end. Then she stode up and gave her maiden mistris Tilney her gloves and handkercher, and her book to maister Bruges, the lyvetenante's brother; forthwith she untyed her gown. The hangman went to her to help her of therewith; then she desyred him to let her alone, turning towards her two gentlewomen, who helped her off therwith, and also with her frose paast and neckercher, geving to her a fayre handkercher to knytte about her eyes.

"Then the hangman kneeled downe, and asked her forgevenesse, whome she forgave most willingly. Then he willed her to stand upon the strawe; which doing, she sawe the block. Then she sayd, 'I pray you dispatch me quickly.' Then she kneeled down, saying, 'Wil you take it of before I lay me downe?' and the hangman answered her, 'No, Madame.' She tyed the kercher about her eys; then, feeling for the blocke, saide, 'What shall I do? Where is it?' One of the standers-by guyding her therunto, she layd her heade down upon the block, and stretched forth her body and said, 'Lorde, into thy hands I commende my spirite!' And so she ended."

The book which she gave to the brother of the Lieutenant

of the Tower is supposed to be one now in the British Museum. It appears to have belonged to Sir John Brydges, and to have been written in by Lord Guildford, and then handed to his wife, who wrote in it a message for her father-in-law, and then, at the request of the owner, wrote a few lines for him as a memento of one unfortunate even to death. The notes are as follows :—

"Your lovyng and obedyent son wischethe unto your grace long lyfe in this world, with as muche joy and comforte as ever I wyshte to my selfe, and in the world to come joy everlasting. Your most humble son tel his death,

"G. DUDDELEY."

"The Lorde comforte your grace, and that in his worde, whearin all creatures onlye are to be comforted. And thoughe it hathe pleased God to take ij of your children, yet thincke not, I most humblye beseach your grace, that you have loste them, but truste that we, by leasinge this mortall life, have wunne an immortal life. And I for my parte, as I have honoured your grace in this life, wyll praye for you in another life. Youre gracys humble daughter,

"JANE DUDDELEY.

"Forasmutche as you have desired so simple a woman to wrighte in so worthye a booke, good mayster lieuftenaunte, therefore I shall as a frende desyre you, and as a Christian require you, to call uppon God to encline your harte to his lawes, to quicken you in his waye, and not to take the worde of trewethe utterlye out of youre mouthe. Lyve still to dye, that bye deathe you may purchase eternall life, and remembre howe the ende of Mathusael, who, as we reade in the Scriptures, was the longeste liver that was of a manne, died at the laste: for as the precher sayethe, there is a tyme to be borne, and a tyme to dye; and the daye of deathe is better than the daye of our birthe. Youres, as the Lord knowethe, as a frende,

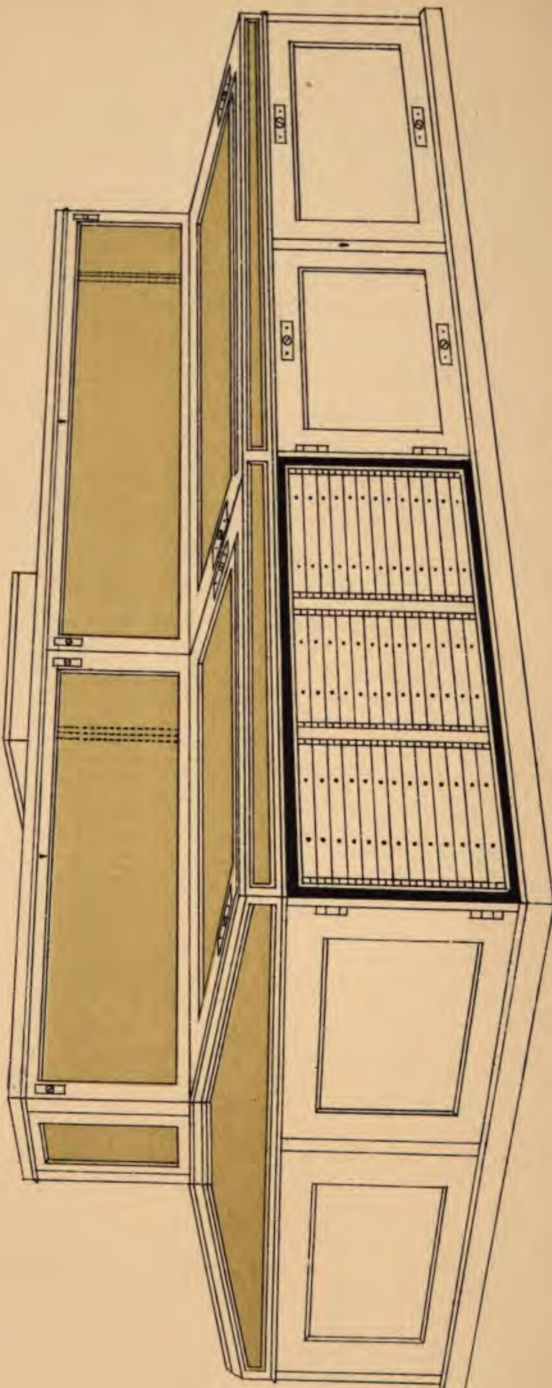
"JANE DUDDELEY."

I need do no more to prove the noble character of her whose life has been thus briefly and imperfectly sketched than quote the words of another comtemporary writer, who

says: "Great pitie was it for the casting awaye of that fayre Ladye, whom nature had not only so beautified, but God also had endowed with singular gyftes and graces, so that she ignorantly receaved that which others wittingly devised and offered unto her. And in like manner that comely, virtuous, and goodly gentleman, the lorde Gylford Duddeley, most innocently was executed, whom God had endowed with such vertues that even those that never before the tyme of his execution saw hym, dyd with lamentable teares bewayle his death."

In order to avoid burdening the narrative with notes, the following list of books is given, to which the writer has been principally indebted for the facts detailed above:—*The Chronicle of Queen Jane, &c.*, Camden Soc. Pub., 1850; *Lives of the Queens of England*, by Miss Strickland; *The Youth of Queen Elizabeth*, by Weisener, 1881; *Lady Jane Grey and her Times*, by G. Howard, Esq., 1822; Bacon's *History of Henry VII; Stories from the State Papers*, by A. C. Ewald, 1883.

PLATE 1.



MUSEUMS OF NATURAL HISTORY.

By HENRY H. HIGGINS, M.A.,

CHAIRMAN OF THE LIVERPOOL MUSEUM SUB-COMMITTEE.

Part I. Museum Visitors.

A volume has recently been published by Messrs. Macmillan, entitled *Methods of Social Reform and other Papers,* by W. Stanley Jevons, M.A., LL.D., F.R.S. One of the papers, which has not previously appeared in print, is on "The Use and Abuse of Museums." On the opening page of this paper occurs the following statement. "In the English language, at least, there is apparently not a single treatise analysing the purposes and kinds of museums, or describing systematically the modes of arrangement."

Papers dealing with departments of the subject have been read before various scientific associations, and it is probable that Museums of Natural History were not exclusively or, perhaps, even mainly in the thoughts of Prof. Jevons when he wrote his severely critical but excellent and comprehensive paper. It is, however, certain that for many years to come no individual will be able to write anything like a complete treatise on this comparatively novel subject. Contributions from many quarters must first be gathered and compared, to supply materials for the Museum Text-book of the future. Bearing in mind the present crisis in systematic classification, it is clear that whatever can now be said on Museums must be of tentative character and provisional value.

Such considerations apply with especial force to the pages which follow. The writer can claim no intimate acquaintance with museums other than those in Liverpool, of which the Free Public Museum, under the charge of its

excellent Curator, Mr. T. J. Moore, Corr. Mem. Z.S.L., with its appliances and surroundings, will form the chief source of his remarks.

The educational value of the Natural History Museum will, no doubt, be made much more conspicuous in time to come. Already the Gallery of Art is recognised as having a more noble aim than to afford good copies for intending painters and sculptors, or even than the introduction of the public to the highest achievements of artistic taste. We are becoming increasingly aware of the *humanising* influence of parks and public grounds for recreation; of street architecture, and free concerts, and window gardens. Something beyond the mere pride of the stable has developed, and still keeps up, the May-day show; and decorative art under a thousand forms is giving silent lessons, increasing everywhere the amount of spontaneously provided culture, and yielding an environment which is incompatible with the lowest experiences of life.

I do not speak of the free lecture and the open reading room, because the crowds who attend them are already well on their way towards self-education. It is of indirect agencies that we are becoming conscious how great may be their influence for good. The seemly shape and pure material of the granite basin, where the donkey-boy and the orange-girl slake their thirst, bring them for the moment in contact with the result of refinement. We *touch* the classes we cannot *teach*, and so that the touch be suggestive of any item in that marvellous category—" whatsoever things are lovely, whatsoever things are of good report "—thereafter follows a desirable result.

To some it may appear derogatory to a museum of natural science to be mentioned in the same breath with a roadside fountain; and my introduction of very homely incidents in connection with so dignified a subject might almost seem to

need an apology, were it not that I trust my readers will kindly bear in mind that I have been in the habit of passing, several times in the week, for years now running into the latter half of their third decade, through museum-rooms which are traversed on the average by more than two thousand visitors per day for the four open days in the week. 23,000 visitors passed through the rooms during three days in Whitsun week, 1884.

I have long been convinced that a series of observations on the constituents of this irregular procession of visitors, combined with overtures suitable for inducing them to make remarks on the objects exhibited—in a word, the application of the inductive method to the examination of human elements *in transitu* through a museum—might lead to much valuable information.

The experiment has been tried in the Liverpool Museum with fair success, and has led, amongst other results, to the adoption by the Committee of a little pamphlet, entitled *Museum Talk*, of which more than twenty thousand copies have been sold in the Museum. It was my intention in this paper to have made copious extracts from notes of conversations held with entire strangers; but sufficient condensation was found to be impracticable. These notes were not designed to include the very valuable remarks made by distinguished scientific visitors, or by students from other museums, but to throw such light as might in this way be obtained on the awakening interest felt by the public in questions affected by Museums of Natural History.

But as days and years passed on, it became obvious that the visitors conversationally approachable were but as the scattered taller flowers amidst the innumerable culms of grass in a meadow. Hundreds of thousands went through the galleries of whom it was in vain to hope that they were deriving much benefit in the way of scientific instruction.

Little parties of children sometimes found the table-cases convenient for racing round; and, when instructed in the decorum due to the place, they would huddle close together, leaning upon the cases, and looking intently upon a coral or a shell, thus indicating their notion of being *good* under supervision. Brothers and sisters, and elders of all grades in affinity, kept up the daily perambulation, noticing a bird or a butterfly or a fossil with desultory but by no means vacant looks. It was easy to see in them mere loungers, and in the children only unmitigated plagues; but it was better to remember that they, of their own accord, had brought themselves for the time into contact with sources of improvement, and that their large numbers made them, after all, the most interesting class of visitors.

Visitors to Museums may for convenience be assigned to to one or other of three classes—Students, Observers, Loungers.

I. To the class of students I should assign all who come with a definite purpose of improving their knowledge of natural productions.

II. Visitors who are not conscious of any purpose beyond a wish to see the Museum, but who fix their attention with more or less intelligence on the objects displayed, may be regarded as observers.

III. It is hardly necessary to characterise the loungers—they form only a small contingent; but with them must, I suppose, be placed the children, as not belonging to a former class, yet deserving to be studied and encouraged.

The classes are bounded by no definite limits. 1,000 visitors to the Liverpool Museum may include—Students, from 10 to 20; observers, 780; loungers, including children, 200.

One other class, however, deserves distinction; and it is gratifying to mention the admission, year after year, of

streams of German and Scandinavian emigrants, who, after seeing their packages piled up at the railway station, seem to pass almost immediately to the Museum or the Gallery of Art. In the midst of the distractions of the most important crisis of their lives, these strong-hearted men and women find time and inclination to increase their stock of knowledge; and, though they are unable to understand the explanatory labels, their conduct strikingly indicates respect towards the institution and its purpose.

To men with more or less of a cultivated interest in science, the teaching of a museum may be said to be direct. It is with its indirect influence upon the mass of visitors that we are now more particularly concerned. The details which make up the friendly relations of a public Museum towards the community at large are multitudinous. Few families are without members in a distant land, all the natural productions of which become endeared to the home circle. A letter from a friend across the ocean describes some adventure in the chase—letter in hand, the museum is sought. A Sunday-class teacher comes to shew his boys the conies "that are but a feeble folk, yet make they their houses in the rock." Jack, lionizing his sweetheart, is more eloquent on corals and coral-reefs than many a Professor of Zoology would feel inclined to be. The list might be extended to almost any length.

That the interests of ordinary observers can ever take the lead in determining the construction or arrangement of a museum, is a groundless apprehension; and yet their recognition seems indispensable to render such an institution all it ought to be, as representing Nature. The finest assemblage of specimens ever brought together would be a travesty of nature without the observance of order in their arrangement, and order in a museum can be preserved no further than science marks the way.

But it is plain that science may be as honourably employed in the process of providing a museum for the people, as in the establishment of a Biological Laboratory. Our foremost English leaders in science have written "Primers" in their respective departments, and probably may have found the task more arduous, and requiring more of original thought, than that of compiling an advanced Text-book. Primers may lead up to treatises, but the museum is the museum, one and the same for all.

Opportunity has been afforded in Liverpool of comparing the attractions of a museum and of a permanent gallery of paintings. After all needful corrections had been made, it appeared that the daily average attendance was in favour of the museum, but that this could not be wholly attributed to the attractions of the Natural History specimens, because the Mayer Collections form part of the Museum. Moreover, in the same set of rooms are exhibited birds in the wall-cases, and invertebrate animals in the table-cases. Observers are more numerously attracted by the birds than by the invertebrate animals. These proportions are reversed in the case of students.

In the correspondence columns of *Nature*, March 11, 1880, a scheme for an annual Conference of Curators was ably advocated by James Paton, of the Kelvin Grove Museum; and soon after appeared communications on the same side by T. Romilly Allen, and E. Howarth, curator of the Museum at Sheffield, formerly assistant in the Liverpool Museum. On the following 1st of April, a correspondent, signing himself "Academicus," succeeded in finding admission into *Nature*, for a brief letter denouncing the whole project, on the ground that what was needed was not meetings for discussion, but the provision of better salaries for curators, such as might secure the services of competent men.

"I venture to suggest in conclusion"—wrote Professor Stanley Jevons—"that the best possible step which could now be taken to improve the museums of the United Kingdom, would be the constitution of a Museum Association on the lines of the well known Librarians' Association. If the curators of all the public museums would follow the example of other professional bodies, and put their heads together in a conference, they might evolve out of the existing chaos some unity of ideas and action. At any rate, they would take the first important step of asserting their own existence. There have been enough of Blue-books and Royal Commissions, and we have heard too much of what 'my Lords' of the Council have got to say. Let the curators themselves now speak and act, and let them especially adopt as their motto—Union, not Centralisation."

PART II. MUSEUM DESIDERATA.

The former part of my paper was prompted by a wish to establish, as a reasonable premiss, that a Public Natural History Museum is an institution for promoting the good of the common weal, by the exhibition of specimens illustrating the order and beauty observable in nature.

One of the first principles to be followed in the organisation of a public museum is Nature's law of parsimony. Profuse, even to superfluity, in objects of beauty and deep significance, nature everywhere economises her means, making one efficient cause serve for endless varieties of use and loveliness. Now compared with the library and oral instruction, the museum, as an instrument of teaching, is very expensive, and at the same time limited in its horizon. By the law of parsimony, the museum should never be required to do what can be equally well done by the less costly agency; but the aid of the library, in the form of printed matter, such as hand-books, plates, diagrams,

tablets, and explanatory labels, should be called in by the museum very much more extensively than is ordinarily the case.

Many museums in which the collections are fairly adequate are rendered almost worthless to the public by deplorable deficiencies in the naming of the specimens: either the labels are inaccurate or altogether absent; or the ink has faded ; or the writing is small and illegible ; or the vibrations set up by the tread of visitors have severed specimens and their names into a most perplexing remoteness ; or the objects exhibited are crowded, overlapping each other and concealing the names ; or the label omits the authority for the name or the locality whence the specimen has been obtained.

It is, however, in the larger groups, consisting of many genera, illustrated by series of specimens, that the evil attains a climax. Where the group begins and where it ends, what characters bind it together, what are its neighbours and what the habits of life distinguishing its constituents, might be matters of complete indifference in some museums. In such institutions the very first *desideratum* seems to be a better treatment of the specimens which they already possess and hoard up to no good purpose.

That museum is a rare one in which a donation of £100 could *best* be spent in the purchase of fresh specimens. In almost all instances, such a sum might be better spent in making the order more intelligible and more instructive; and much of this good work might often be done without spending a pound.

The importance of brief descriptive labels attached to the larger groups has been already alluded to. Take, for example, the two groups of Humming-birds and Sun-birds. In one museum every species in both groups shall be accurately named, and the groups shall be arranged after the

most approved authority; but without further illustration. In the other museum the groups shall be almost without specific names, but a conspicuous tablet shall call attention to the life history, affinities, and geographical distribution of the birds. Which museum is doing the better work? One is tempted to ask—What can the long list of specific names in the former museum teach beyond the fact that such were the names first given to the birds, probably in some museum hundreds of miles from the locality where they were collected? The case of a collector wishing to name his specimens will be considered presently. Identification in exotic groups is rarely required by visitors, and may be more efficiently done by the use of monographs in books.

Let imagination lead us to the interior of a museum *sanctum* in London, Paris, or Berlin. On the floor shall be a large travel-worn box of bird-skins, over which stoops the Naturalist owner, just returned from the tropics,—a spare, dark-skinned man, who is emptying the box and placing its contents in rows upon a table, by the side of which sits a Professor learned in Ornithology. He carefully examines the fresh arrivals one by one, smoothes their ruffled plumage, strokes them tenderly, spreads and counts the feathers in the tail, and notices especially the bill and the claws; after which many of the samples are tossed by with indifference; but at length comes one more highly to be prized—"Ah! this is new to science," pronounces the great authority, "this must have a name,"—and the heart of the Naturalist swells with joy and pride. But, alas, the winged treasure was brought to him from a distance by the natives, and he knows no more of its habits than the Professor in the chair, who, nevertheless, will give it a name and add the postscriptive *mihi*, meaning that the name is given by his authority.

Such are the thoughts suggested to myself by labels barren

of everything beyond the two-pronged Greek and Latin title, and the name of its authority. Yet such a combination is very necessary, and is also good, where it is not used as a substitute for fuller information. Museums, however, are hardly yet awake to the thought that anything beyond the identification of every species with reference to its place in a printed monograph can be required.

Work done in the accurate naming of species, and in the careful compilation of synonyms, need fear no disparagement: it is the very basis of the application of Biology to other departments of natural science, such as Palæontology. If, however, by the omission of life-history illustrations, the museum teaches an observer or a student that the great aim of a collection is to have every object correctly referred to its place in a book, it is doing positive mischief.

Much more might be said upon the subject of labels—those many-voiced appliances which are to the museum as organs of speech; but it will be difficult to avoid referring to them again when systematic classification is before us. For the present it may be enough to insist upon the paramount importance of putting the museum into communication with the outer world, by a thoroughly efficient system of labels not confined to generic and specific appellations.

Second only in consideration to the labels, are the indications of the *passage of a living hand,* recently, over the collections. In a public museum where the cases are supposed to be, but very rarely are, dust-tight, their contents if left to themselves soon acquire an indescribable aspect of neglect. I remember to have seen many very respectable series of insects, birds, shells, etc., wearing such an obsolete look as to repel the advances of all except the most resolute observers.

Of course, no well-advised curator would suffer a mere

porter or a charwoman to remove specimens from their places to be cleaned or put in order; yet the sight has been too common of names and objects in such a medley as could hardly be accounted for in any other way. The curator himself, with his assistant, must do the re-arrangement, and, if the museum be at all an extensive one, this will occupy them two whole days per week, which is equivalent to one-third, or more, of their time, and makes periodical re-arrangement a far more expensive matter than is usually taken into account. Yet that too frequent uncared-for look *must* be banished from within the walls of the museum if it is properly to fulfil its functions.

Moreover, if that which is valuable and instructive is to be respected, objects of mere vulgar curiosity must be stringently excluded. A friend recently informed me that he saw in a museum, representing the regard for natural science in a wealthy county, a glass-case containing, together with specimens of natural history, a remarkably small pair of breeches worn by a foreign nobleman who had not long before resided in the district. Silver prize-cups gained in athletic sports, and cricket-balls with which a famous local match was won, are said to be frequently deposited in provincial museums by their ambitious owners.

To meet such and such-like incongruities, the paradox has been propounded that it is the chief duty of the managing committee to keep things out of their museum. Well, at all events, the acceptance of contributions, coupled with conditions as to their exhibition, has frequently been found permanently disadvantageous; yet, when presented by a friend or an influential neighbour, such well intentioned but mistaken favours are most difficult to be declined. As a general rule, it is desirable to record the name of donors on the labels attached to their contributions; but it should be distinctly understood that gift-specimens are accepted

under no conditions whatever, except that they shall be exhibited, or not, as may best promote the interests and efficiency of the museum.

That the collections in a museum should represent the best and most recent acquisitions in every department in Natural History will be conceded by all. But where is the money to come from? Where does the money come from in the case of private collections? It notoriously is depressing to pass from inspecting private cabinets, rich with costly varieties and treasures almost in superfluous abundance, to notice the poverty-stricken aspect of the series in the museum of the district, and to see what beggarly specimens are thought to be good enough for the benefit of the public.

Collectors are not chiefly to blame. Frequently they are very liberal, but few like to give away their best things, though it might repay them well to restrict their own collections more completely within special groups, giving to the public even their finest things in other departments, as our respected member, Mr. F. Archer, and his brother, Surgeon-Major Archer, have done. Collectors, moreover, are much in the habit of making over their entire collections to the local museum; and at this moment I am able to recollect a considerable number of museums indebted for all their best treasures to the generosity of private collectors.

In forming an estimate of the kind of acquisitions desirable to be made by the expenditure of funds available for a museum, *one*, that was never dreamt of till within the last half-century, comes prominently forward—if indeed it should be called an acquisition rather than an extension and a true yoke-fellow. I mean the Biological Laboratory. No museum can be complete without it; though it is not, strictly speaking, a part of the public museum, since it is the room specially set aside for students in prosecuting purely scientific studies.

The laboratory should be near, but not contain, the marine and freshwater aquaria, which must, of course, be open to the public. It is the proper place for the storage of all considerable series of specimens which cannot be examined without the use of the microscope—such as slides of all kinds, together with mounted *Rhizopoda*, *Radiolaria* and *Diatomaceæ*, magnified models and plates of which will, of course, be found exhibited in their proper places.

The consignment to closed cabinets, either in the laboratory or elsewhere, of all important specimens, too small or too obscure to be examined without handling, will effectually promote observance of the law of parsimony; for strict economy is nowhere more essential than in exhibition space. A specimen openly displayed, if it be not contributing its full quota to the illustration of the group to which it belongs, is doing actual mischief. Plenty of margin gives to an instructive form an emphasis which should by all means be jealously preserved against the encroachments of things insignificant. I do not know a more effectual damper upon any gratification to be obtained from the inspection of good and striking specimens, than to find them, like standard-bearers, heading interminable processions of mites, attaining the maximum size of a pin's head.

Very probably the microscopic forms may be the most interesting of any? Yes, in their right place, where they can be handled and put under a lens. But what is aimed at in occupying valuable exhibition space by long rows of labels with minute black specks between them?

It is partly on this ground that I venture to differ from some very high authorities who recommend that provincial museums should, by preference, contain the local or the British Fauna. The immense majority of British or local invertebrate animals are not proper objects for public exhibition, because of their extreme subdivision into species,

and of their diminutive size. Series of names, surmounted by their all-but invisible owners, may be very flattering to the diligence of the collectors, who would, nevertheless, I feel sure, for the most part readily forego the personal credit in behalf of a more public benefit, such as the profitable occupation of the exhibition space in a museum by objects at once attractive and instructive.

In days gone by, it was often needful for collectors of local species to resort to a museum table-case for the purpose of naming their specimens—the easiest, but the least instructive, method that could well be devised. Now, however, monographs of almost all the classes in the British Fauna are easy of access, and it is in every way better for the Naturalist to be able to name his collection by the beautifully clear and instructive descriptions given in recent works.

Symptoms of senility have manifestly overtaken the nomenclature of natural science, when the British examples of *Chironomus*, a single genus of small insects allied to gnats, have reached a total of one hundred and ninety five species, distinguished chiefly by the fractional proportions between the tibia and metatarsus in the fore-leg of the insect. (Walker's *British Diptera*, vol. iii.)

Amongst Museum DESIDERATA, *common* things sometimes have an undesirably distinguished place. In 1871 I accompanied Professor Huxley through the rooms containing the invertebrate animals; and I remember that the only thing for which he made special enquiry was the Drone of the common Hive-Bee. (Hélas!) After his esteemed visit, it was not *long* before the Drone was in its place, with the Queen and Worker Bee.

There remains a question, the consideration of which may suitably bring this portion of my remarks to a close. In a public museum, ought it to be a special aim to illustrate the *beauty* of natural objects? Such a question could

hardly arise with reference to order, for order is acknowledged to be Nature's character in chief. Yet beauty is but a special form of order, having this peculiarity, that to minds suitably cultivated and disposed it gives immediate pleasure through the eye.

Nature can be fairly represented only in museums where due recognition and representation is conceded to phenomena associated with beauty. For example, the amazing wealth of beauty in certain families; the prevalence of beauty altogether beyond the sphere of the operation of protective mimicry or of sexual selection; and, most wonderful of all, the fact that super-eminent beauty is sometimes found in extremely rare and isolated forms, nothing in the least like which are known.

A scientific friend, referring to a proposed establishment of circulating museums, writes in good hope that they will "tend to counteract the predominating wordiness of our primary education. Symptoms," he adds, "are already occurring which make me fear that incapacity for observation, and for learning anything except from books, is spreading from the higher classes to the lower." It is not necessary here to defend the claims of literature, but amongst the civilised portions of the human race this excessive and exclusive dependence upon books has not always been a friend to improvement.

After all, we may be too anxious that a museum should be, characteristically, a place for learning lessons. Should we ourselves always welcome the presence of a science-teacher recommending attention to his instructions in the meadows of the Engadine or even on the top of our own Bidston Hill? Should we not sometimes wish to be left a little more alone with Nature? Let us remember that, for Nature, the grandest museum in the world is only a very imperfect substitute.

My most extreme views of museum reform have never contemplated the turning of a museum into a kind of silent school. If we must have for the museum a scholastic comparison, let it rather be more closely compared with the playground.

Sir James Paget, in the *Nineteenth Century* for December last, expresses much of what I would have a museum be—a place for recreation by wonder, not for idle curiosity, ever so vivid, but for delightful, refreshing, heaven-sent WONDER, true child of intellect and emotion.

PART III. MUSEUM ARRANGEMENTS.

The revolution which, within the last twenty-five years, has been accomplished in all the provinces of Biology, might naturally lead to the expectation of an entire change in the systematic arrangement adopted in museums. It has already become trite to announce that the animal and vegetable kingdoms are perfectly united in their lowest classes—that every animal or plant is genetically related to every other animal or plant—and that no single ascending or descending series of examples can adequately represent the order of nature.

Together with fundamental considerations of this kind, has arisen a fully justifiable enthusiasm for a new aspect of Biology unheard of in any former age. To suggest that post-Darwinian museums may possibly, in outlines of arrangement, much resemble the older ones, calls forth an excusable impatience; and for myself, in venturing to plead the prudence of being fairly "on with the new love" before forsaking the old—and that there are points of arrangement worthy of being preserved—I can only state that I am not insensible to the conjuncture, and by no means wish to stereotype a plan for the museum of the future.

The task of arranging the collections in a museum on a

ground plan, such as to represent to the eyes of visitors the genealogical affinities which are the only real links in the animal kingdom, involves many difficulties that for the present seem to be insuperable.

No such general scheme has ever been produced, even on paper.

The phylogeny of no class has been ascertained.

The ancestry of a single well-defined animal form has in very few cases been determined, Professor Huxley's celebrated derivation of the horse from a three-toed ancestor being perhaps still the most notable example.

Since the development of the theory of evolution, some biologists have thought that the phylogeny of the animal kingdom might be represented by a *stammbaum*, or genealogical tree, with its stem and branches.

If a *stammbaum* were traced upon the floor of a room in the Museum, and table-cases with glass tops for typical specimens were put in places indicated by the furcations of the classes, an extremely interesting appliance for giving instruction would thus be constituted. But, to accommodate only a moderately large collection of recent and fossil forms on this plan, might require a space as large as that on which St. George's Hall stands; and it would be very difficult for such an exhibition to avoid giving an erroneous impression as to the present state of our knowledge of the phylogeny of animals.

Future modifiers of the museum ground-plan may possibly assign a room to illustrate the phylogeny of a subkingdom—for example, Mollusca, with cases arranged conformably with the divisions in Professor Ray Lankester's schedule (*vide* Article Mollusca, *Ency. Brit.*, 1884), in which the plan is admirable, and very instructive on paper, but if carried out on a ground plan, the extreme want of balance

between the divisions must entail great loss of exhibition space, and defeat the original intention.

The following are some of the Relations in which groups of invertebrate animals may be illustrated in a museum. They are noticed in the order of their supposed importance, combined with suitability: other relations of equal, or even of greater, importance being regarded as subordinate, if they can be more advantageously taught by books or in the class-room.

I. General life-history, as free as may be from technical terms, and including such common-sense information pertaining to the group as may, in the apprehension of an ordinary observer, serve to distinguish it from other allied groups. This essential illustration may conveniently take the form of a tablet about the size of an octavo page, printed in large type, so as to be *easily* read.

II. What may be termed the body of the group, consisting of exotic specimens typical of the families, genera, and species constituting the group: preference being given to the finest, most beautiful, and most significant forms.

III. British species representative of the group, for ordinary reference; but especially for comparison with foreign forms in the same group.

IV. A selection of fossils showing the earliest appearance of the group in the geological series.

V. Specimens, and anatomical preparations, of the constituents of the group, preserved in liquid.

VI. Specimens of nests and habitations; galls and their tenants; eggs and egg-cases; webs and tissues; larvæ and pupæ; timber and stone pierced by molluscs, crustacea, and insects.

VII. Examples of mimicry; of protective colouring; of unusual contrast between male and female of the same

species; of malformations, distorted growths, healed fractures, and restorations.

VIII. Extended series of species and varieties belonging to the group, not for constant exhibition, but to be seen on application to the curator. This department may include all such specimens of the group as are of microscopic size.

IX. Economic products of the group used in manufactures or art; silk in various stages; dies and pigments; cameos, from the rough medallion cut from the shell, to the finished work; pearls and mother-of-pearl; polished shells; beads, and other ornaments of coral.

X. Models, drawings, diagrams, plates, and photographs of animals belonging to the group, and of their structure, anatomy, and embryology.

XI. Schedule, indicating the systematic position of the group in the sub-kingdom to which it belongs.

For the purpose of illustrating, in such a variety of aspects, the almost countless hosts of invertebrate animals, it has been found convenient to divide the whole series into groups with limits much more stringent than any which are to be found in nature; but the same defect pertains to all systematic divisions in zoological text-books without exception.

Animals without bones, in the Liverpool Museum, occupy twenty table-cases, ten feet in length by five feet in breadth, thus affording 1000 area feet of horizontal exhibition space. These cases accommodate 240 trays or drawers, each holding a group and capable of being removed for lecture purposes, or of being used as a drawer in the cabinet portion of the table-case. The cases support an upright compartment, to be spoken of presently. Each drawer measures twenty-seven inches from back to front, and is sixteen inches in width, thus affording three area feet of exhibition space. One third, more or less, of each drawer towards the front is divided longitudinally into three equal spaces—the central

space containing the tablet; the right-hand space, the British species; and the left-hand space, the earliest fossils of the group.

I. Little need be said of the tablet of general life history. It is one main final cause and *raison-d'être* of the plan, the distinctive feature of which is the GROUP, which is freely admitted to be an unnatural mode of division, tolerable only for the sake of the comprehensive sum-total of relations which cannot otherwise be exhibited throughout the whole of the classes and orders of the boneless animals.

II. Two thirds of each drawer, *i.e.*, two area feet, are assigned to the display of world-wide forms. It has been suggested that since the shells of molluscs are merely secretions, and stony corals are nothing more than pseudo-skeletons, so large a portion of exhibition space is not due to them. To which it seems to be a sufficient answer that provision has been made for representing the soft parts in the upper compartment. It is, moreover, the hard parts which show very much of nature's differentiating work through evolution and natural selection, as may be seen in the larger genera, such as *Madrepora*, *Catenicella*, *Mitra*, &c. Here too, if anywhere, must appear a suitable acknowledgment of the exquisite grace and beauty lavished by nature on certain groups; a feature not less of great value, because such characteristics are still very much beyond the interpretation of science and cannot be displayed in books or in the class-room. "A specimen without a history, or even without a name, that calls forth a genuine exclamation, 'How beautiful!' fulfils a noble mission." (*Synopsis Liv. Mus.*, 1880.)

III. That the British species of any group should be consigned to a corner occupying only a ninth part of the including drawer, may appear to be most unworthy treatment; and since this arrangement is confidently recom-

mended in preference to the exhibition of an ordinary collection of British invertebrate animals, it is desirable to state what may be urged in its favour.

In the first place, it is of extreme rarity in museums to find anything like all the classes and orders of the British invertebrate Fauna represented even by so much as a single specimen. Long rows of each species in *Lepidoptera* and *Coleoptera* are supposed to constitute a fine collection of British insects. It is time that this false impression should cease. How has it arisen?

In a great measure through the absence of any provision made in museums for the reception of such forms as *Spongida*, *Coelenterata*, *Polyzoa*, *Echinodermata*, *Crustacea*, *Myriapoda*, *Arachnida*, and the less known orders of *Hexapoda*. I am able to speak from the experience of many years, as to the vivid interest communicated to a search for specimens, whether out of doors or in the hands of dealers, by the knowledge that whatever desirable example might occur, its proper place in the museum was already waiting for it, and that it would improve one or other of the groups.

Another advantage may be mentioned — the comparison of British examples with world-wide forms of the same group. Out of the 240 groups, 159 contain recent British forms for comparison: a field of intense interest to the student of natural development through the influence of environment.

In many of the 159 groups containing British species, their space is not restricted, and they are suffered to overflow, even to the extent of occupying two-thirds of the drawer, as in the case of *Noctuæ-genuinæ*.

The whole space occupied by British species is somewhat less than one hundred area feet, which is equivalent to the area in an ordinary cabinet of sixty drawers. Micro-

scopic and soft-bodied specimens being excluded, such a space is found to be adequate for most of the typical species in *all the classes and orders* of British invertebrate animals.

IV. The association of recent animal forms with the fossils of which they are the present representatives, readily commends itself to all careful observers of Nature; but it is is attended by difficulties.

If the association be made by placing a large portion of the main series of invertebrates in juxtaposition with a corresponding portion of the main series of fossils, *e.g.* the Crustaceans with the fossil Crustacea; the enormous differences between the living forms would dwarf the differences representing the progress made during ages of evolution. The living Crustacea differ far more one from another than from any of their ancestral fossils.

Yet the *Crustacea* form relatively a small class. In the *Mollusca*, it would, I think, be requisite to shut off from both the recent and the fossil series select portions for illustrating the desired comparison; a plan which resembles the group method.

In the two hundred and forty groups of invertebrates, eighteen are without fossils; seventy have only fossils difficult to be procured; and ten are constituted wholly by fossils, *e.g. Rugosa, Rudistes, Cystoidea, Trilobita*, &c., of which no recent forms are known.

These four—the tablet of life-history, together with British, fossil, and world-wide types, occupy the horizontal spaces of the two hundred and forty groups. The schedule of systematic position stands outside the drawer in front; whilst six other relations are attempted to be displayed in the upright compartment, where they are seen under a very miscellaneous aspect, which, nevertheless, appears to be far more attractive to visitors than the more orderly contents of the drawers below.

The relations numbered V, VI, VII, VIII, IX, X, XI, cannot now be fully discussed without separating, too widely, parts of the general plan.

Something should, however, be said on the scale which, together with the group method, was adopted for the Liverpool Museum before the rooms, or the cases, or more than a very small portion of the specimens, were in readiness.

To occupy one thousand area feet with examples typical of most of the genera of invertebrate animals, must necessarily be a work of time; nevertheless, a collection on a similar plan and scale has, within the last few years, been successfully made in the Nottingham Museum, chiefly through the exertions of Mr. G. B. Rothera.

There seems to be no reason why a collection on a scale one-fourth of that in the Liverpool Museum might not be carried out on the same plan, the groups being of the same size, but sixty only in number; in which case the apportionment might, perhaps, conveniently be as follows :—

		No. of Groups.			No. of Groups.
1.	Protozoa	1	15.	Crustacea	4
2.	Spongida	1	16.	Myriapoda	1
3.	Infusoria	1	17.	Arachnida	2
4.	Hydrozoa	2	18.	Heteroptera ...	1
5.	Zoantharia	4	19.	Homoptera	1
6.	Alcyonaria	3	20.	Diptera	1
7.	Polyzoa	2	21.	Lepidoptera ...	4
8.	Brachiopoda ...	1	22.	Neuroptera	2
9.	Lamellibranchiata	4	23.	Orthoptera	2
10.	Gasteropoda ...	8	24.	Coleoptera	3
11.	Cephalopoda ...	3	25.	Hymenoptera ...	2
12.	Echinodermata ...	4			—
13.	Scolecida	1			60
14.	Annelida	2			

My object in recording so many details is to save the time and trouble of those who are engaged in promoting the establishment of Natural History Museums. They will find their booksellers able to supply them with little to help them in the choice of plans, and nothing whatever, that I am aware of, to enable them to decide between one method and another of arrangement, as better suited to their own circumstances and resources.

Lastly, in the case of collections already established, arises the difficult question, how far it is expedient in a public museum to attempt to follow out changes in arrangement such as are continually being suggested by investigators in embryology, or more generally, in ontogeny. The museum does not profess to be arranged on the principles of ontogeny, which do not recognise or even admit the existence of a linear order, though some modification of a linear order necessarily obtains in every museum and in every text-book on Zoology or Botany.

Botany is now sustaining an attack of which it is hard to say whether it will prove to be an ill-advised rebellion or a glorious revolution. Zoology is saved only by its vastness. Yet the systematic work of such men as Linnæus, the brothers Jussieu, Cuvier, Milne Edwards, Owen, and Agassiz, must endure,—in support whereof suffer me to put a case.

If the affinity of a number of species a_1, a_2, a_3, be clearly established on embryological grounds with species in the hypothetical group B, it by no means follows that a_1, a_2, a_3 ought to be placed with b_1, b_2, b_3 in group B. They have affinities with others of the 'a' tribe in group A, and there may be stronger reasons for retaining them in A than for parting with them—a contingency involving the permanence of group A.

For example, *Gregarina* is at present a member of the group *Protozoa*. But *Gregarina* may probably be a degraded

form descended from some Turbellarian ancestor amongst the worms. Ought *Gregarina*, therefore, to appear amongst the worms? No one who has seen Haeckel's beautiful plates of the life history of *Monera*, and who knows the similar processes in *Gregarina*, would contend for this.

It is certain that through embryology light is now dawning on difficult questions in Biology; and no museum can afford to teach as though such revelations were not being made. I am persuaded, however, that there is no better plan for a museum than to adhere to the system adopted in some good recent treatise; and, for the purpose of infusing the scientific life of the day into the collections, to rely upon special forms of labels, which, as I have before said, ought to be organs of voice to a museum.

You have submitted to you from the Mollusca in the Liverpool Museum, arranged in accordance with the *Genera of recent Mollusca*, by Henry and Arthur Adams, two groups, including *Chitonidæ* and *Dentalidæ*, distinguished by a large distinctively-coloured taxonomic label, and a narrow frame of the same conspicuous colour, in the hope that the structural significance of their soft parts may receive due attention. Provisionally, the *Brachiopoda*, *Tunicata*, *Polyzoa*, *Limulus*, and some other forms may be similarly distinguished.

A reply may be anticipated that, on the same principle, the whales might be retained amongst the fishes by pinning a large taxonomic label on their backs. Doubtless, if the exigencies of museum accommodation so required. But the case is different. *Cetacea* and *Sirenia* are clearly Mammals. When all the Tunicates are as clearly shown to be, at this present time, vertebrates, and *Polyzoa* and *Brachiopoda* to be worms, it will be necessary to carry out, as far as possible, corresponding arrangements.

Part IV.—Museum Appliances.

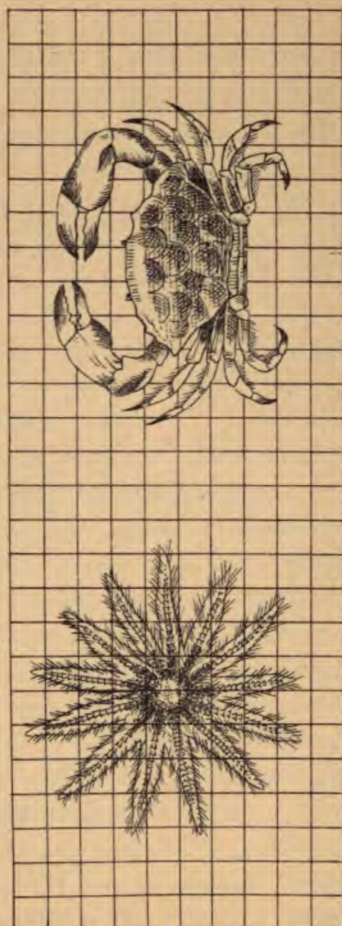
1.—Protection from Light.—So injurious was known to be the long-continued and direct action of light upon a large proportion of museum specimens, that two roller-blinds, one of brown holland, the other of black and nearly opaque stuff, were affixed to each skylight in the invertebrate rooms. The working of the opaque blinds has been attended by some inconvenience, and they are not now in use. Suitable lengths of American oil-cloth are carefully kept on the sloping parts of the table-cases at all times, except during exhibition hours.

Insects suffer very much from direct exposure to bright lights; especially the crepuscular and nocturnal *Lepidoptera* in which the delicate shades of green, brown and rose soon become faded. Colours which are purely the phenomenal effects of the optical laws of interference, in other words, which depend on striations and not on pigments, remain uninjured, *e.g.*, *Morpho Cypris*. Shells suffer, subject to the same limitations. The nacreous interior of *Haliotis Iris*, in which there is no pigment, retains its splendid iridescence, whilst some shells fade; and amongst the corals, the delicate Hydrocorallinæ assume a bleached appearance. Such a mortifying liability to deterioration is sometimes urged as sufficient reason against displaying beautiful but perishable objects. The needless sacrifice of a unique treasure cannot be defended; but for specimens which can be replaced, no better end can be desired than an honourable decay in the service of the public.

2.—Protection from Dust.—The penetrating power of particles floating in the atmosphere exceeds what is easily credible. Cabinet work of the most finished kind was stipulated for in the specifications for the table cases. Slips of velvet border the lids beneath, as well as the upper edges of

PLATE II.

FIG: 2.



XANTHO florida.

SOLASTER papposa. (*underside*)

FIG: 4. 1 INCH TO A FOOT.

FIG: 3. 1 INCH TO A FOOT.

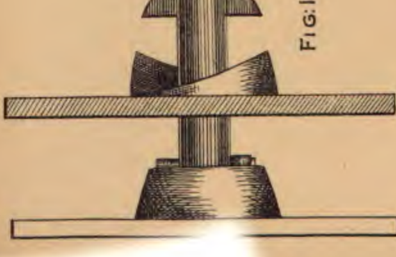


FIG: 1. SECTION.

FIG: 1. ON THE LID.

FIG: 1. ON THE CASE.

the cases, so that velvet closes on velvet; and the lids when shut are screwed down at each end by a half-turn clamp (Fig. 1), besides being locked in the centre. Piano-hinges, the whole length of the lid, are used; and below the hinge runs a tin gutter to catch any stray particles that might fall through an invisible chink: in spite of all which, the continued trampling of thousands stirs up swarms of impurities that find their way into the cases to an extent that is positively painful, and admits of no remedy except by passing every group under the good offices of a loving hand at least four times in the year.

Hence will be readily understood my strong advocacy of the use of a glass covering under the lid of the table-case. In the *Insecta, Arachnida,* and some of the *Crustacea,* the groups occupy corked-drawers similar to those used in entomological cabinets, with double sides for camphor, and glass covers. The worst form of atmospheric deposit appears on the glass lids of the table cases as an intensely black disc, the size of a small pin's head. It is often overlooked, and is not removed by any ordinary amount of rubbing. It seems to act chemically upon the glass, and, when removed by the point of a pin, leaves a microscopic scar upon the glass. A beautifully transparent but soft kind of plate-glass should be avoided for table-cases, for in the process of dusting the rubbers pick up particles of sand, which leave minute scratches on the glass.

3.—Divisions of the Groups.—Tablets, neatly made of baywood, one-eighth of an inch in thickness, are found to possess so many advantages that it is good economy to have them cut by machinery, in sets of all suitable sizes, and kept in stock. Where the specimens in a group are few and large, the tablets preserve a symmetry which is agreeable to the eye; and where the specimens are small and numerous, the tablets are found to economise space, enabling the

drawer to give orderly accommodation to the largest number of species. Tablets are suitable for *Crustacea, Annelida, Echinodermata,* and *Mollusca.* Wherever coloured drawings are required in the groups, it is desirable to mount them on tablets, and to cover them with glass of the same size, suitable paper being pasted on so as to form a narrow and perfectly dust-tight margin.

The longitudinal divisions in the drawers for insects may be made by inserting the required number of drawing-pins in the cork at the back and at the front, around which scarlet corded-silk is passed, after which the pins are pressed in up to the head, holding the silk firmly, but admitting readily of being changed. Baywood ribs, a quarter of an inch in breadth and one-eighth of an inch in thickness, form very convenient divisions in the groups of *Crustacea, Mollusca,* etc. These, long enough to pass from the front to the back of the drawer, should be kept in stock, and can be cut to any required length.

4.—SECURITY AGAINST DISPLACEMENT.—Insects, scorpions, spider-crabs, etc., are sufficiently secured by pins; but larger crabs and some shells require to be firmly held in their places, or the vibrations caused by the constant tread of many visitors would send them wandering off, far from their names, in all directions.

Perhaps it may be worth while to trace the development of a tablet from its beginning to its completion. Hundreds, of various sizes, are received together from the hands of the cabinet-maker. One may be selected, suitable for a small crab or a pair of shells, size 2¼ by 2¾ inches.

It has first to be papered, and for this purpose I will suppose it placed in the hands of my very efficient assistants, Mr. F. P. Marrat and Mr. John Chard.

A sheet of the required paper is spread on a table; the tablet is then carefully pasted on one side, which is to be laid

upon the paper. The point of a penknife is passed round the margin, cutting out from the sheet the papered face of the tablet, which is then to be smoothed and pressed. The rough edges are removed by scraping them on a piece of fine sand-paper, and the tablet when dry is ready to receive the label. This should be fastened by a pin at each end, clipped off flush with the surface—a plan much to be preferred to the use of paste, on the principle of building a bridge for a flying enemy. *An obsolete label is an enemy to a museum,* and every facility should be given for its speedy removal in favour of a correct one, which is always a friend.

The tablet is now ready for its specimen, *e.g.*, a univalve shell. The easiest and, unfortunately, the most common way of avoiding displacement is by gluing the shell on the tablet, thereby destroying its character as a natural object, and turning it into a piece of museum furniture. Special cases occur, though rarely, in which a touch of isinglass may be requisite, as where a smooth shell has to be fixed in the best position for the display of its operculum. Various other modes may be described, obviating the necessity of *gluing down,* which in the case of small shells seems to me to be simply barbarous.

Many ordinary shells, crustaceans, echinoderms, etc., may be firmly held in any required position on the tablets by the judicious use of a few pin-points, standing from one-eighth to three-quarters of an inch in height from the surface of the tablet, holding up the specimen whilst they remain quite unseen. Another and, in many cases, a better plan is the use of pill-box lids. These, when the heads are removed, form circular or oval rings on which the specimens rest very securely. The rings being quite out of sight, such shells as Pectens and Tellens are raised, with an excellent and almost stereoscopic effect.

Smaller shells may be placed in shallow porcelain

saucers, such as are used by artists in water-colours, varying from half-an-inch to two inches in diameter. For still smaller specimens, the saucers may be placed in pill-boxes loosely filled with cotton-wool. When the glass lid of the pill-box is put on and pressed down, the cotton holds up the rim of the saucer in contact with the glass, so that the shells cannot fall out. Besides appearing on the label, the name of the species is written on the bottom of the box. For all *small* objects, excepting insects, I regard this as quite the most perfect mode of exhibition; the security and mobility of the specimens, their pleasing appearance, their entire protection from dust, and from becoming separated from their names, and, lastly, their adaptation for examination by a lens, leave little else to be desired.

Glass tubes, used for homœopathic medicines, are convenient for very small objects, such as *Foraminifera*, kept in a dry state.

Small glass phials, of which the part below the neck has been compressed and flattened in the process of making, are excellent for specimens requiring to be kept in liquid—*e.g.* (Fig. 2), *Entomostraca*, many worms, British *Myriapoda* and *Arachnida*. With the aid of a crochet-needle, the legs and palpi of spiders can be very effectually displayed in these flattened phials.

5.—The Upright Compartment.—This is eighteen inches in height and nine inches in width; the floor and the top are of glass, to avoid casting a shade on the objects below. It is divided into two portions, each five feet in length, by a central upright, notched in correspondence with another at each end, so as to be capable of sustaining, at any required height, two or more plate-glass shelves.

On the floor of the compartment and on the shelves may be placed sloping frames of brass wire one-tenth of an inch in diameter. (*See* Fig. 3.) These are found to be very useful for

Sub-kingdom MOLLUSCA, Animal soft, fleshy.
Próvince CEPHALOPHORA. Head distinct.
Class BRANCHIO-GASTEROPODA.
Water-breathing. Crawling on the belly.
Sub-class PROSOBRANCHIATA. Gills in front
Order PECTINIBRANCHIATA. Gills like a comb
Sub-order PROBOSCIDIFERA. Trunk retractile.

MILLEPORA, L.
M. alcicornis, Linn:
var. delicatula, Duchass:
Grenada, W. Indies

CASSIS, Browne.
C. Madagascariensis, Lam:
Cameos in various stages.
Nassau, W. Indies

"ARGO" EXPEDITION, 1876.

BRITISH SPECIES.

FOSSILS OF THE GROUP.

SOLASTER, Forbes
S. papposa, Linn.
British

PAPILIO, Fabr.
Machaon, L.
Britain.

PRESENTED BY S.S.

NERITA. L
N. polita L.
Philippines PRESENTED BY MISS YATES.

H.H.H.

MUREX, Linn.
M. tenuispina, Lam.
Eastern Seas.

PRESD BY REVD H. H. HIGGINS.

Sub-genus PHYLLONOTUS, Sw:
MUREX rosarium, Chem:
Senegal

PRESD BY SAML SMITH.

PLATE IV.

For Taxonomic Labels.

For Fossils.

For British Specimens.

For Foreign Specimens.

Cloth used for Corals.

supporting coloured drawings of anatomy and transformations; also for glass-topped boxes displaying examples of mimicry; special geographical assemblages, *e.g.*, shells from Lake Tanganyika, economic products, malformations, healed fractures, and for a large portion of the examples illustrating relations already mentioned. The upright compartments in about twelve table-cases are fitted up with these glass shelves and brass wire frames. Some of the corals require the undivided height of the compartment.

Large sponges and echinoderms are advantageously exhibited in the upper compartments by a lattice of brass wire running half the length of the table-case, and forming a network of square meshes, one inch to the side of each square. (Fig. 4.) The larger starfishes and crabs suspended on this kind of lattice, exhibit their undersides equally well with the upper. Brass wire frames for holding single specimens are used in the upper compartments, with the great advantage of forming the least possible obstruction to the light.

6.—USE OF COLOUR.—Different shades of neutral tints may be employed to distinguish the tablets for fossils, and for British and foreign specimens. (Plate 4.) A drawer lined with dark-blue cloth seems to suit corals. Lampblack tablets, with names written in white paint, answer well for sertularian zoophytes, pressed flat, and lightly touched here and there with india-rubber dissolved in spirits of turpentine, an excellent and very durable adhesive mixture. Examples of other colours used in labels will be found appended. (Plate 2.)

CIRCULATING MUSEUM.—At the commencement of the present year, a scheme was set on foot for supplying the schools and other educational institutions of Liverpool with a succession of groups of natural productions, suitable for use in giving object lessons. It was thought that previous

attempts of the kind had been less successful because of the inferiority and want of character in the specimens. Grammar collections, as they have been called, made but a feeble appeal to capacities sufficiently sensitive to the attractions of striking and beautiful objects.

The circulating museum is designed not so much to teach Mineralogy or Ornithology, as to promote the happiness derivable from the intelligent observation of a crystal or a bird; in other words, to *train* the faculties through which Nature may be a lasting source of pure enjoyment.

Groups of specimens belonging to some limited division in Zoology, Botany or Mineralogy, are placed in suitable receptacles, generally boxes about sixteen inches cubic measure, with shelves and necessary trays. These have been sent out, and very cordially accepted by the teachers; but the experiment is too recent to admit of results being estimated.

A CENTRAL LOAN COLLECTION, for lecturers and private teachers, has been commenced.

CONCLUSION.

THE BRITISH MUSEUM.

Circumstances did not permit me to see the British Museum collections in Natural History, from the time when they were first beginning to be moved to Cromwell Road, till an opportunity which was afforded me during the month of June in the present year, whilst I was on a visit to several museums besides those in the Metropolis.

It would probably be difficult to find a public exhibition of natural productions without some features worthy of notice and commendation. Museums are, however, subject to strange vicissitudes. It is enough that they fulfil their

current functions, which they will do more or less efficiently in proportion as they are in correspondence with their environments. They cannot be stationary, dependent, as they greatly must be, upon the presence and care of a kindred living spirit.

In the neighbourhood of a once glorious aquarium upon the south coast, has sprung up a museum of nature and art, small, but refreshing from the studied intelligibility of its labels. "We have no funds here for specimens," said the curator, "everything you see has been obtained as a loan, or as a gift, or by exchange."

Upon any one familiar with our national collections in their former home, the first impression made by the sight of them in their present condition might reasonably be—how vast a work has been done here! But it would be followed by a second, at least equally strong—how much remains yet to be done! And a concluding conviction might perhaps follow—how much has been left desirable which can never be done, or only with extreme difficulty, in the present building. Whatever may be the architectural merits of the edifice, very much has been sacrificed to them, even if thereby certain important advantages have been secured.

The chief galleries do not seem to yield themselves readily to afford space for vivid illustrations of nature. Take, for example, that in which the recent mammals are arranged. What an opportunity has been lost for erecting a grand unique hall of animals, to be disposed in groups suggestive of their affinities, life histories, and geographical distribution. Is this too much to be expected in a national museum? The materials are there, in the shape of an extensive, and possibly matchless, series of the highest forms in the animal kingdom; but they are *unavoidably* consigned to cases having a contour scarcely more individualised than the pens in the mile-long avenues of an agricultural show.

What the true workers in the management of the Museum are willing and able to do, may be recognised by the use they have made of the gallery on the opposite side, which has been assigned to fossil mammals. I should be quite contented to let this gallery stand for an example of the results attainable when the specimens of a really fine collection are not forced into being over-crowded; for here, perhaps, less than one hundredth part of the species in the recent series has been treated worthily, and with a magnificent result, unparalleled, I think, elsewhere in the whole world, and inclining the visitor to contemplate with indescribable emotions these representative remains of mighty rulers over sea and land in former ages.

Few would be similarly interested in the gallery of recent animals. It may be said that museums are not designed to excite raptures in weak-minded people, but to serve the interests of science. Then why such elaborate architectural decorations? Are *they* carried out in behalf of purely scientific instruction?

It is true that an equally effective arrangement of recent mammalia would require a space greatly exceeding the area adequate for fossil quadrupeds, not only through the greater number of species, but because each recent form should be surrounded by ample illustrations of its life history.

The thought of such a hall is almost overwhelming; but where are we to look for an appreciation of that which is necessary fairly to represent Nature, if not within the walls of a metropolitan natural history museum? The building, if it were ever so magnificent a pavilion, must be regarded as only one amongst a thousand others, many of them much finer than itself. The biological collection must stand alone.

In some important departments, the collections are not yet exhibited, but it would be too sanguine to expect in them more than it has been possible to attain in the parts

now open. When the *Mollusca* and the *Arthropoda* shall be completed, there will be found in them evidences of the same loving care and unimpeachable skill that may be recognised in the arrangements of the *Cephalopoda*, and in the admirable drawings of Ammonites, etc., which accompany the specimens.

But the sense of unrelieved uniformity, and that of a very mediocre kind, is, to say the least, not helpful in the presence of treasures gathered from all parts of the world. On the contrary, to look down the whole length of a shed where small cases in pairs, all alike as peas, form a vista of from fifty to a hundred feet in length, without a break, or anything to suggest that their contents once had living relations, is disappointing. Let the scientific naming be ever so perfect, the thought *will* intrude—Is *that* the best that can be done to shew the store that is set by objects that have cost money and brains and lives? It is easy to picture to oneself a dealer with his box, marching down the vista. To him the thing is perfection, for there is nothing to bother him or draw off his attention. He knows that time is money; so once down and once back is sufficient to stock his note-book with names, and forthwith he straps up his cases and departs perfectly contented.

The accommodation allotted, in some cases, is so inadequate that I would sooner have seen in the S.W. a building on the model of the Bethnal Green Museum, but with ample areas, and, whatever it might be *without*, all glorious *within*. I fear the West-end requires to be educated before it would endure such a structure placed permanently so near Belgravia.

To prove that this is not written at random, let me give an instance. To the same corridor (it is little more than a corridor, and not a very long one) are assigned the *Hydrozoa*, together with the Corals and the Sponges. What a noble

gallery would the Corals fill if they were allowed to be seen in specimens appropriately grand. They alone, with a few typical fossils, would require twice the space of their whole gallery, which, of itself, would be no more than sufficient for the sponges only. Occupying the end of the room, it is refreshing to see a wall case containing *Polyzoa*, a class of moss-like animals unsurpassed in beauty and interest, yet never exhibited in Great Russell Street. They seem here to be placed out of harm's way—perhaps out of the way of doing harm to anyone's taxonomic reputation—for their systematic position is a matter not to be safely handled except with great delicacy.

It may be urged that the immense extent of the collections renders it all but impossible to combine with all the specimens details illustrative of their life history. This is quite true, and hence the hearts of thousands of lovers of Nature leaped at the promise of an index collection in the British Museum. It was thought to be the very thing to supply what was so much needed—not a mere concordance for finding things in the main series, with "gallery and case" substituted for "chapter and verse," but an arranged series of shrines, each rich with nature's first sketches of the central form, lighted up with illustrations and explanations of environments, and made attractive with beauty of colour, grace of form, and delicacy of structure, fully displayed by models and drawings, supplementing an assemblage of carefully-selected examples.

It was generally reported that the alcoves around the entrance hall were to be occupied by an index collection. At present only one alcove has been used. It contains some very instructive examples of birds, but is manifestly only in course of completion. Parenthetically, I may refer to the little cases of stuffed birds, with nests and eggs, in the stone galleries. Some of them are hardly suitable to be thus

distinguished; but others are exquisitely tender and lovely, and are truly artistic works, executed in full sympathy with bird life. The index collection, if generously completed—for there should be no stinting, or withholding of fine examples in fear lest they should become faded, as if this was only an inferior department—would form, to the majority of visitors, by far the most interesting portion of the British Museum. And for those who might come to the National Museum in search of suggestions how to make small provincial museums at once popular and instructive, the index collection would be of the highest possible value.

Under any circumstances, the formation of an index collection must be a work of considerable difficulty. The alcoves seem to be only moderately well suited for the purpose, but would be much better adapted if the mammals, birds, reptiles, and fishes were to be otherwise provided for. The great hall of mammals, containing full illustrations of life history and surroundings, would render an index collection on the same plan quite needless. The birds would require a similar hall, and occupy it with the same result. Reptiles and fishes might together fill a third hall, thus relieving the index collection from the necessity of making provision for vertebrate forms. This would be an immense help; but, on the other hand, plants would have to be included in the index, and would seriously diminish the number of alcoves available for invertebrate animals. Corals and sponges, if more adequately housed and treated, might not require places in the index collection, which would then be chiefly occupied with Arthropoda and Mollusca. The main series of the former would be left in closed cabinets, much as they were before removal; but the "index" alone would accommodate a far finer series of insects than were ever seen by the public in Great Russell Street; and both these and the shells would be greatly enhanced in interest when accompanied on the

plan adopted in the "index," or as it might more appropriately be called, the "illustrated," collection.

The Botanical department seems at present to be little more than a magnificent store of herbaria, together with a wondrous library, the formation of which must have involved a combination of skill, diligence and good luck, for the book-market is not always at the command even of a full purse. This department would, no doubt, be glad to occupy as many of the alcoves as could be spared, but a substitute for Kew Gardens cannot be lodged within the walls of a museum, and nothing less than a very capacious hall would be suitable for the exhibition of a national collection of seeds, fruits, woods, fibres, etc., most of which are, or recently have been, exhibited at South Kensington.

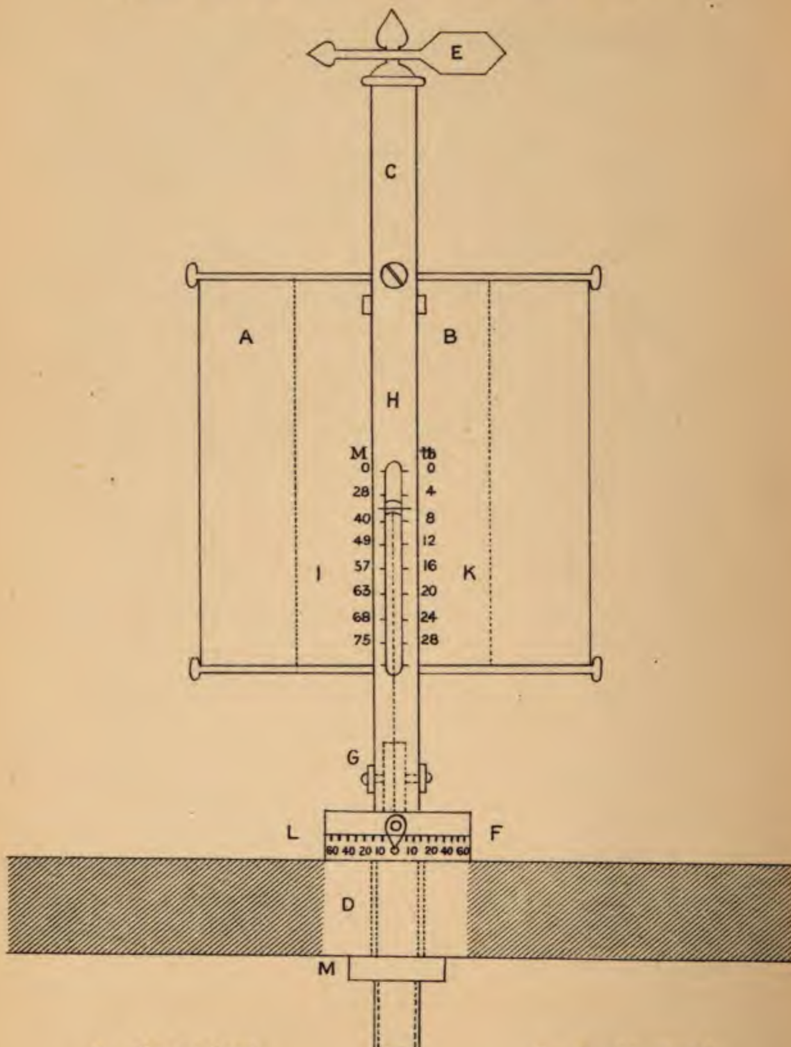
It may seem presumptuous for me to enter upon such great questions as are involved in the requirements of a National Museum, but I think that no expenditure of public wealth can be extravagant if incurred to mark a deep sense of what Museums of Natural History must be made *now* in preparation for a coming time. It is sheer folly to regard museums as continuations only of what they were in the days of Linnæus.

One distinctive triumph — the discovery of unity in Nature—has marked our age more than all that has been done in electricity, or spectrum analysis, or in any branch of physics; yes, more even than that astonishing course which has led up to probable victory over a hitherto unvanquished foe—Hydrophobia. Not one of these, nor the whole of them together, has practically affected the life of an entire generation, as Evolution has done. It is of no use to shut our eyes. Intelligent men in this country, under middle age, are evolutionists; and this will work for good or ill in proportion as they may be induced to be evolutionists from observation and the study of Nature; or, on the contrary, as they may

base their confidence in evolution upon authority. Does it not come to the same thing if the man be an evolutionist, after all? No, it is not the same thing. The thousands that have picked up Mr. Darwin's theory, with little trouble, and can argue for it and beyond it, Are they the same as he was? There is danger of a recurrence of the old story in another sphere; for the 'authority' teaches just as much as he thinks proper, and no more. NATURE, INDEED, TEACHES EVOLUTION, BUT WITH IT TEACHES ALSO A GREAT DEAL MORE.

The most exalted function of a museum is not so much to instruct, as to win and encourage minds to get themselves instructed through habits of observation.

MARINE ANEMOMETER.



A. *Large Sail.*
B. *Storm Sail.*
C. *Mast.*
D. *Railing.*
E. *Vane.*
M. *Screw Nut.*

F. *Double Plinth*
G. *Pulley.*
H. *Spring.*
I. *Scale Miles.*
K. *do Pounds.*
L. *do Degrees.*

W. G. BLACK. F.R.M.S.

SHIP ANEMOMETER.

By W. G. BLACK, F.R.Met.S.

THE present instrument is designed for practical use on board ship in all weathers, so that it may enable the officer in charge to judge by *mechanical means* of the force of the wind on the sails at any time required.

The principle of the Anemometer is derived from the *sail of a ship*, the pressure of the wind upon which is transmitted by a cord going under a pulley to a pointer moving on a scale similar to that of a common spring-balance.

The *sail* of the instrument has dimensions of twelve inches square for ordinary weather, or twelve inches by six inches for stormy weather, and is made of waterproof material. It is attached to a *fixed yard* of brass at the upper part of the mast, and to a movable yard at its foot below, hanging free from the mast.

The *mast* is a hollow brass tube of about two feet long, which has a free vane at the top to shew the direction of the wind, and is attached below to the railing of the ship, suitably placed for observation, and is bolted on it by a plate above and a nut below turning on a screw. In the upper part of the mast lies a *spring wire coil*, fixed to a plug above, and free below to another plug carrying the pointer, which slides up and down in a slit in the front of the mast, facing the wind.

The *cord* tied to the lower yard passes under the pulley, which is placed on the lee side at the foot of the mast, and then passes upwards inside it, to be attached to the lower movable plug of the spring coil.

The mast is planted on a *solid plinth* of metal below, and

this revolves horizontally on the upper surface of a like solid *plinth* underneath it, which is fixed to the railing by another but wider tube passing through it, and screwed on by the nut below.

The *upper plinth* turning horizontally on the lower one will thus allow the mast and sail to be turned to face the wind, according as the direction is indicated by the vane on the top.

The *scale* on one side of the slit in the mast indicates pounds pressure of the wind, at the ratio of five inches to twenty pounds, occasioned by extension of the cord on the pulley, and the *other scale* on the other side indicates the corresponding *miles* in velocity of the wind, at the ratio of five inches for sixty-three miles per hour.

If the *smaller sail*, having an area of half-a-square foot, be used instead of the larger one, then a pressure of eight pounds to the square foot would be indicated by the four pounds on the scale, and forty miles velocity would be the rate of the wind blowing, instead of twenty-eight miles velocity.

The larger and smaller *sails*, for use in fine and stormy weather, are therefore made *interchangeable* on the mast, and they are attached to brackets which are screwed on and off as required.

A *dial of degrees* is cut on the outside line of the lower fixed plinth, and a *pointer* is fixed on the rim of the upper moving plinth, which will indicate the bearings of the sail and vane to the course or position of the ship at the time of observation.

By means of this instrument the navigator will be enabled to ascertain by inspection the general direction and pressure of the apparent wind, and its angular relation to the ship's course.

From these data he would be enabled to calculate the

force, velocity, and direction of the *true wind*, and this not by any complex numerical method, but by easy geometric or graphic means.

When *observing*, the instrument will be turned round so that the *sail lies facing* the apparent wind, as indicated by the direction of the vane, and then the *pounds pressure* can be read off, the *velocity* of the wind, and the *angle* forwards contained between the wind direction and the ship's course.

A *parallelogram* of these compound forces can then be drawn, in which the *diagonal* will represent the apparent velocity in miles per hour, and *one side* the rate of the *ship's sailing* in miles per hour. The containing *angle* between these two is obtained from the dial of degrees, and the *third or resulting* side will indicate approximately the direction and velocity in miles per hour of the *true wind.*

Take the instance of a *steamer* going at the rate of seventeen miles per hour, with the apparent *wind* on the right fore quadrant, at an angle of 45° with the *ship's course* forward, and shewing a pressure of three pounds or twenty-four miles per hour velocity. Then the *triangle* so projected would be completed by drawing the *third side* between the two given points, which would be found on measurement to be seventeen miles also, which would indicate the *velocity* of the true wind, and its pressure would be about one-and-a-half pounds per square foot, and its direction just abeam, or 90°.

Again, suppose the *steamer* to be going fifteen miles per hour, with the apparent *wind* in the fore right quadrant, at an angle of 67½° with ship's course forward, and shewing a *pressure of* three-quarters of a pound per square foot, or 11·25 miles velocity per hour. Then the *triangle* would be completed by joining these two points by a *third side*, which on measurement would be found to indicate *fifteen miles*, or

one-and-a-quarter pounds of pressure, and 45° aft, for the elements of the *true wind*.

A further practical point that will be indicated by the use of the gauge, will be the measure of the resistance sustained by the ship in passing through the air on the surface of the water. The pressure in pounds per square foot, multiplied into the number of square feet in the area of the section of the ship, corresponding to the plane of the sail, would give the total resistance of the air to the motion of the vessel. Say that the section above water line was 30 feet broad by 14 feet deep, or 420 square feet, then the pressure of air resistance would be, at 4 pounds per square foot, equal to 1,680 pounds, against velocity of air or wind ahead of 28 miles an hour.

It may be added that the instrument has been experimented on during a voyage from Liverpool to Brazil and back, and is spoken of by the captain of the ship as having answered perfectly; and I have also used it myself in the steamer plying between London and Leith with satisfaction and interest. The pressures indicated by the gauge do not appear to have been as high as might have been expected, and on these voyages seldom rose above 4 pounds to the square foot, so that for ordinary purposes a range of scale of 10 pounds to the square foot would be sufficient for moderate or fair weather.

COMMUNISM, ANCIENT AND MODERN.

By H. LONGUET-HIGGINS.

The history of human progress is in a great measure the history of the rise of new ideas, and certain it is that every great social change, and every great change of belief, has been preceded by a change in the opinions and modes of thinking current among the masses. Hence especial interest and importance attach to that tendency of thought or opinion called Socialistic or Communistic, which of late years has increased greatly in strength, especially upon the continent. Socialism is far more modern than Communism, using the latter term in its widest sense, and a *Socialist* is properly one who would *compulsorily* modify the present distribution of property through the intervention of the State. But the terms Communism and Socialism are often used synonymously; their origin is uncertain,* and it is very difficult to find a satisfactory and universally accepted definition of either word. Communism, in its widest sense, includes Socialism, and embraces all schemes having for their basis the total abolition, or greater or less modification, of the principle of private property with a view to the common welfare. The great political importance of Communism and Socialism arises from their calling in question the fundamental institution of private property, upon which the fabric of modern European society and civilisation has been reared. Hence they demand the most serious attention alike of the philosopher, the philanthropist, and the politician. And the

* But see Mill's *Political Economy*, Book II, ch. i, s. 2, where it is said that the word Socialism originated among the English Communists. It has, however, been ascribed to Louis Reybaud.

importance of the subject seems increased when we remember how very small a share definite arguments have in determining both national and individual opinions. Most men arrive at their opinions, even their most cherished ones, by far other processes than that of reasoning. Rarely do we recognise how much we are intellectually bound by ancient or modern Authority,* hereditary opinions, and our feelings.

The rise of each communistic scheme or system is undoubtedly to be traced to the general social and intellectual conditions of the age which produced it, and these conditions again depend on those of the preceding ages. It is therefore proposed, so far as is possible in the limits of a short paper, to examine modern Communism or Socialism by the historical method, and inquire into its intellectual and social origin.

To the great stream of communistic thought two main classes of ideas have contributed, the one political, the other religious or legal. And it will be seen that both have, though from different causes, been deeply imbued with the great principle of *equality*, which has in all ages exercised so profound an influence over human thought.

Communism and Politics.

Plato's *Republic* contains the most celebrated ancient communistic scheme. It is purely political, and its author belonged to a nation where the life of the citizen was chiefly devoted to the service of the state.

In modern times, the chief political schemes are those of St. Simon and Fourier, which arose out of the French Revolution, and were taken up in this country by Robert Owen and his followers. Their intellectual origin is due to the influence of the writings of Rousseau, which did so

* See Sir George Cornewall Lewis's work, *The Influence of Authority in Matters of Opinion.*

much to hasten the coming of the Revolution. Rousseau, as is well known, laid down the theory of man in a supposed *state of nature*, irrespective of all history, and he believed that a social order could be evolved from this state of nature. Sir Henry Maine has well shewn * how this political idea of a state of nature arose from a misapplication by the French lawyers of the old Roman so-called *Law of Nature*, which declared that all men are (that is, in the eye of the law) equal. For this the French jurists substituted the proposition that all men are *born* equal, and therefore *ought to be* equal. This principle of the fundamental equality of men was adopted in the American Declaration of Independence, and has thus already exercised, and will probably in the future continue to exercise, great influence on political and social ideas.

The Social Influence of Religion.

Very great has been the influence of religious and legal ideas upon the social development of the progressive races. The non-progressiveness of the greater portion of mankind is owing, in a great measure, to a bondage to ancient legal and religious systems. Law and Religion were originally united, and it is only among those races where Law has been gradually disentangled from Religion that there has been any material progress in civilisation; for Law is far less rigid and more capable of modification than a religious system. Literature—or, rather, a superstitious reverence for ancient books, texts, words, and even single letters—has aided very largely in preserving the rigidity of ancient religious systems, and, though in a less degree, of legal systems also. The Chinese and Mahommedans have from this cause remained in intellectual bondage for centuries. We are now, however, concerned with the progressive races

* *Ancient Law*, pp. 93, 94.

only, and especially with ancient and modern ideas and opinions respecting Persons and Property.

First, then, as regards *persons*. Ancient law took little or no account of individuals as such; the unit of society known to ancient law was the Family.*

Much of the influence which gradually led to the emancipation of the Individual and individual property was due to the influence of religious ideas. The Church has in all ages had much to do with property, and, especially in Europe, with the distribution of property upon a man's death. In ancient days, many of the heathen temples possessed the privilege of preserving and registering wills; to this privilege the Christian church succeeded, and it is but twenty-five years ago that the ancient ecclesiastical jurisdiction in this country over wills and administrations was abolished. The Church was, perhaps, not altogether disinterested in this custody of wills and testaments, as the priesthood in all ages and countries have taught the laity that the road to future happiness is paved with donations and bequests to the Church. On the other hand, the Christian church has ever been the guardian and asserter of the claims of the Widow. The Church was also the chief means of introducing the power of disposition by Will into the laws of Western Europe, thus taking one of the most important steps in the gradual formation of individual property; for the power of willing necessarily implies the existence of individual private property. The Church has, therefore, always been adverse to the ancient joint forms of ownership.† Christianity had also in another way a great share in the gradual rise to importance of the Individual. Ancient morality was exclusively *national;* that is to say, the welfare of the State was

* Maine, *Ancient Law*, p. 258.

† Maine, *Early History of Institutions*, p. 104; *Early Law and Custom*, p. 83.

the ultimate end in view.* This was particularly so in ancient Greece, and the same thing is seen in the system of Confucius, where the welfare of the State is the supreme end to be attained by individual rectitude. Again, as ancient societies were unable to conceive of the Individual as a separate social unit, they confounded the morality of the individual with that of his family or tribe, who were held responsible for his acts, and the sin of a criminal was considered to be visited upon his posterity. Christianity reformed this idea, and by its teaching of individual immortality gave a great impulse to the importance attached to each individual life. We see the same progress from Nationality to Individuality in the evolution of the great religions, a purely national religion being generally succeeded and reformed by one in which the ideal *personal* element (marking the growth of morality) predominated. So we find Brahmanism succeeded by Buddhism, and Judaism by Christianity and Mahometanism. And in each case we find that the reforming religion is strongly missionary, or proselytising in character, this arising from the religion having burst the bonds of a narrow nationalism and having recognised the necessity for an universal faith.

The social teaching of Religion is eminently communistic in character. Each of the two greatest religious systems the world has seen—Christianity and Buddhism—has taught men that a spirit of universal brotherhood and charity is to be aimed at; that competition is an evil, and that poverty rather than wealth is acceptable in the sight of heaven. This teaching of these two vast systems of religious thought is, of course, intimately connected with the great principle of Asceticism which underlies it, and which has had so profound an influence on the progress of thought. The communistic societies and schemes arising from Christianity are

* *Ecce Homo*, p. 125.

very numerous; among them may be named the early Christians, the monastic orders, the Moravian Brethren, and many of the modern American communistic bodies.* They differ from political communistic societies in being *voluntary* in character.

Religious *ideal* schemes of society have also been very numerous, from the *Civitas Dei* of St. Augustine onwards; but, unlike the modern political schemes above mentioned, they have had little or no influence on the thought of the present generation.

POLITICAL EVOLUTION.

Much light is thrown upon the origin of Communism and its place in the history of opinions, by a consideration of two great lines along which the development of the European nations appear to have proceeded; the one political, the other social. Let us first take the course of political development. The earliest tie which appears to have held men together would appear to have been that of Kinship, which gradually, as a tribe settled down in a country, became exchanged for a *territorial* bond arising from several families or tribes occupying the same area of land. The idea of Sovereignty is, in like manner, first personal and then territorial; the idea of a King changing from that of a *personal leader* or chief to that of a *territorial ruler*—as we see in the case of King of the French becoming King of France. The influence of the *land* in both cases is evident. We find, however, that the development of the idea of a *State* followed a different course among the Greeks and Italians on the one hand, and the Teutonic nations on the other. Among the Greeks the highest political idea of a State was that of an independent and ruling City or cities; and the Greeks never

* For a brief but interesting account of these religious societies, see a little book entitled *Socialism and Communism*, by M. Kaufmann (S.P.C.K., 1883).

became a Nation in our modern sense of the word. The same may be said of the Romans. But among the Teutonic nations, who have been influenced in a far greater degree by territorial ideas, the development has been from tribes into a Nation, which is a far more permanent form of a State.* The political pulse beats quicker, and political life is more brilliant but more shortlived, when a City is the chief political idea of the State. This is why we might expect to find new political and social ideas developed earlier in Paris than in any other city in modern times, for the French metropolis is remarkable for its independence of and non-sympathy with the provinces. To the student of political history from a social point of view Paris is, next to Athens and Rome, the most interesting city in the world, and to such a student the most striking feature in its recent history is the so-called Revolution of the Commune in 1870. This, it should be remarked, had nothing to do with Communism. The Revolution of the Commune was a protest against over-centralisation of government. The great principle of decentralisation is that a political society should be based on smaller units, without destroying the cohesion which holds them together as a nation. It is simply carrying out, in the political organisation of Society, the great law of the emancipation of the Individual and individual rights, which the history of the Family and of Ownership has ever exhibited. We have in this country been gradually carrying out the principle in the increased facilities for local government, and no political principle is of greater importance to Western Europe. For in each Teutonic nation the cities have gradually risen to great importance; and if the modern system of *national* states is to be permanent, the principle of decentralisation of government must be largely extended. As with individuals, so with cities, counties, and colonies, their

* Freeman, *Comparative Politics*, lect. iii.

individuality must be cherished and encouraged, and government from a distance avoided as far as possible. In other words, a wisely limited form of home-rule for internal affairs is the best way of cementing and fostering a sense of political union. And where peoples, united under the same sceptre, are not only geographically separated, but are of different races, it is especially necessary to enforce this principle.

The fact that a Teutonic Nation is, through decentralisation, capable of combining, or rather absorbing, into itself the brilliant City constitution of ancient Greek and Roman civilisation, justifies the brightest hopes for the stability of modern States. The gradual development of local government simply carries out in States that law of evolution, which in social life has gradually disintegrated the Individual from the Family. We may, therefore, look forward to a great extension of the principle. And French Communalism (as distinguished from Communism) is, as we have seen, the struggle to obtain freedom in France for the application of decentralisation.*

Social Evolution.

Another great line along which the evolution of human society has proceeded is the social, and this in a great measure depends upon the development of ideas with respect to Ownership. And most important of all is the history of the idea that there could be absolute ownership of a *person.* The most remarkable instances of the gradual emancipation of the Individual from the ancient bonds of the Family, are the cases of the Slave and the Married Woman. In primitive society, individual life had not that sacredness which it afterwards acquired; the father was absolute owner of the persons of his wife, children, and slaves, and among both our

* See an article by Frederic Harrison on *The Revolution of the Commune.—Fortnightly Review*, 1871.

Teutonic ancestors and the ancient Romans it was for the father to say whether a newborn child should be brought up or exposed. That is to say, *absolute property* in persons was allowed. Again, it is little recognised how greatly the progress of civilisation is marked by the social and intellectual estimation in which women are held. The Christian church, to its lasting honour, has ever been most jealous in protecting the property of the Wife; but it has remained for this century to see not only the final renunciation of the principle of slavery, or absolute property in persons, but also the complete recognition of the proprietary independence of married women. It is now (February, 1884,) but little more than a year since the long history of the property of the Wife has ended in the complete assertion by the English legislature of her independent rights; and it is noteworthy that this has been contemporaneous with the wonderful change that the last twenty years has seen with respect to the recognition of the intellectual rights of women. Their political rights will, perhaps, be the last to be acknowledged.

Ancient and Modern Views of Life.

Socialism also arises out of the modern social or industrial view of life, which has succeeded to the mediæval ascetic view, which latter again divides modern civilisation from the greatest civilisation of ancient times—the Greek. In Greece, the welfare of the State being the supreme object, the view of life was political, and the ideal which the Greek set before him was fitness or beauty, especially physical and intellectual beauty. Hence sculpture and architecture, concerned chiefly with public buildings, reached a perfection they have never since attained. In mediæval times, the present life was considered as almost insignificant in comparison to the next. Hence the spiritual welfare of the Individual became the highest ideal of life, a sour, selfish

asceticism spread over Christendom, and the natural and healthy love of physical beauty was repressed as an evil thing. Modern life is essentially social and industrial, and Political Economy, the scientific expression of the modern industrial philosophy, represents the extreme negation of Asceticism, the watchword of the latter being mortification, that of the former, development.*

The history of Property shews a corresponding evolution of the rights of individual private ownership, property having been originally held in common by the tribe or family. In the department of thought, too, we can trace a slow transition from collective bondage to ancient Authority to individual intellectual freedom of inquiry and belief.

Mr. Herbert Spencer traces three great stages in political development—first, the early stage, when the welfare of the state or social group is the supreme primary object; secondly, the stage when, the society having grown strong and well knit together, the furtherance of *individual* welfare is the chief aim; lastly, the stage when, individual rights and welfare being fully established, the higher moral view of *social* welfare becomes uppermost.† In this last stage it is seen that *voluntary* (observe, not *enforced*) co-operation, for the benefit of all, is the highest aim of social life. And then, and not till then, does a higher and nobler idea of Property arise, namely, that of a trust for the benefit of all.‡ But at the same time, the old notions about the natural equality of men spring up with increased vigour. Let us see what modern science has to say upon this point.

Socialism and Science.

Modern science teaches us that inequality is ineffaceably stamped upon men, and that Competition, which socialists so

* Lecky, *The Rise and Influence of Rationalism*, vol. ii, p. 363.

† *The Data of Ethics*, p. 148.

‡ Sheldon Amos, *The Science of Law*, p. 158.

bitterly denounce, is one of the great laws of human as of other life. The testimony of the modern science of Biology is clear on this point, and another department of modern science, Political Economy, teaches us the same thing; for most, if not all, economists admit and assert that competition is the cause of all social progress, and that the great incentive to labour and economy is individual interest.

The fundamental idea of Socialism is to reduce the present inequalities in the distribution of wealth, and the cry of the socialist is that the inequality is ever increasing—that the rich are growing richer and fewer, the middle class poorer and fewer, and the poorer classes still poorer and more numerous. What is the reply of Social Science, through her handmaiden—statistics? The income-tax returns for the last forty years go to shew that the rich are growing poorer and more numerous, the middle classes richer and much more numerous, and the poor, in proportion, at once less numerous and very much richer.* And the President of the London Statistical Society, in a recent address,† gives a most interesting set of statistics connected with this subject. Let us hear and mark well the conclusion he arrives at from the figures: "We find undoubtedly that in longer life, in increased consumption of the chief commodities they use, in better education, in greater freedom from crime and pauperism, and in increased savings, the masses of the people are better, immensely better, than they were fifty years ago."

Why have Communistic and Socialistic Schemes of Society hitherto Failed?

Science also enables us to answer this question. It is

* See an article in the *Edinburgh Review* for January, 1884.

† *The Progress of the Working Classes in the last Half-Century:* Inaugural Address, by Robert Giffen. London: G. Bell and Sons, 1884.

because they have not observed one or other of the great laws of human nature or social evolution.

(1.) The *religious* communistic societies have failed because they are founded on the ascetic view of human life, and (in many instances) encourage celibacy, both being contrary to the law of social development. Also, because they do not respect at all, or too greatly interfere with, the great law of the evolution of individual property from joint property, and the law of Competition.

(2.) The *political* communistic schemes have also failed because they too have transgressed the two last-named laws. The great Continental scheme for the compulsory subdivision of landed property on the owner's death is founded on false principles. On the one hand, it tends to check the natural and healthy growth of population, and is therefore contrary to one law of social development; on the other, it restrains that freedom of testamentary power which marks the complete emergence of individual ownership from joint property, and therefore offends against the above-mentioned law of property-evolution.

Socialism and Social Reform.

May we not, from the foregoing, gather some hints for the progress of that true and beneficent Social Reform which has done and is, happily, doing so much to prevent the demon of Continental Socialism from crossing to our shores and stalking abroad in our land?

Social Reform, guided in its footsteps by Science and the modern Comparative and historical method of inquiry, will respect and guard to the utmost the rights of private individual ownership, including the full power of testamentary disposition. It therefore will not seek to better the masses by such schemes for the diffusion of landed wealth as, in England, the so-called "land-nationalisation," or the Conti-

nental plan of compulsory division of land on the owner's death, both of which, as we have seen, offend against the laws of social and proprietary evolution. But it will strive by every legitimate means to promote the welfare of every member of the community, and especially, by means of compulsory education, to give to every individual an equal chance of bettering himself, recognising that the reform must be from *within*. For universal education, by raising the condition of the masses, will materially aid in that diffusion and *comparative* equalisation of wealth which, as we have seen, is actually in progress. True social reform looks forward to a great extension of the principle of Co-operation, and of those voluntary co-operative societies and schemes which have already borne such good fruit in England, France and Germany. Also to a still further extension of the spirit of brotherly love and help, as manifested not only in co-operative schemes, but also in philanthropic institutions, such as hospitals, free libraries, and public parks. It believes not in any sudden change, but in that gradual but sure amelioration of the state of the law and the condition of the people which is step by step, here a little and there a little, removing those just grounds of complaint which still remain. And it relies on an ever increasing practical sympathy among the upper classes with the condition and wants of the masses.

In the domain of politics, the great principles of decentralisation and local self-government should be fostered and carried out, so far as this can be done without weakening the sense of national unity. "The welfare of the State is best consulted by the increase and free use of the forces of the Individual, and the removal of whatever has hitherto hindered the Individual from obtaining that degree of well-being which he was capable of reaching by exertions according to the best of his ability." Social Reform holds that

this great principle applies not only to individual persons, but to political units, such as the city, the county, and the township, and still more so to individual countries united under the same government. It will leave as much as possible to be effected by the great influence of public opinion and the spirit of private enterprise and philanthropy, believing, with Mr. Herbert Spencer, that over-legislation is a bad thing.

Lastly, in the present infancy of International Civilisation, we hail with joy the ever-increasing respect among nations for the sacredness of the individual rights and property of each other. For this is a sure sign of a growing sense that nations are indeed brothers under one All-Father, which justifies the brightest hopes for the future of mankind.

REMARKS ON THE FLORA AND FAUNA OF OCEANIC ISLES.

By R. J. HARVEY GIBSON, M.A.

It is only within very recent years that the subject of the distribution of plants and animals on the globe has attained to anything like scientific importance. It is true that naturalists were more or less acquainted with the ranges of the various organisms whose structure they studied, as a series of isolated facts; but it was impossible for them to make any generalisations on that knowledge until the true relationship of living things to each other and to their environment was clearly grasped.

It was only after the hypothesis of Evolution was generally adopted that it became evident that, as Mr. Wallace expresses it, "each animal could have come into existence only in some area where ancestral forms closely allied to it had already lived," so that "a knowledge of the exact area occupied by a species or a group was as real a portion of its natural history, and of as much importance as its habits, its structure, or its affinities; and that we can never arrive at any trustworthy conclusions as to how the present state of the organic world was brought about, until we have ascertained with some accuracy the general laws of the distribution of living things over the earth's surface."

It was equally necessary, however, that many doubtful points in geology should be cleared up, and especially that investigations should be made with regard to the alleged existence of continents, in past geological epochs, where now the earth's surface is covered by oceans many thousands of feet deep.

It is unnecessary to restate here in detail the important conclusions recently arrived at by geologists with regard to this latter question, as a result of the investigations of H.M.S. "Challenger," as well as of a careful consideration of the structure of islands and of continental areas. While referring members of the society who are interested in this subject to Dr. Archibald Geike's address to the Royal Geographical Society (1879) for a summary of the facts on which the doctrine of the permanence of continents is based, I may be permitted to quote one or two sentences as stating briefly this all-important principle.

Firstly. The present continents have retained the general position they now occupy since their original formation; and although often partially submerged, they have never at any time formed the floor of a deep ocean.

"Among the thickest masses of sedimentary rock—those of the ancient Palæozoic systems"—writes Dr. Geike, "no features recur more continually than the alternations of different sediments, and surfaces of rock covered with well-preserved ripplemarks, trails and burrows of annelides, polygonal and irregular desiccation marks, like the cracks at the bottom of a sun-dried muddy pool. These phenomena unequivocally point to shallow and even littoral waters. They occur from bottom to top of deposits which reach a thickness of several thousands of feet. They can be interpreted only in one way, viz., that their deposition began in shallow water; that during their formation the area of deposit gradually subsided for thousands of feet; yet that the rate of accumulation of sediment kept pace on the whole with this depression; and hence that the original shallow-water character of the deposits remained, even after the original sea bottom had been buried under a vast mass of sedimentary matter. . . . . . In short, the more attentively the stratified rocks of the crust of the earth are

studied, the more striking becomes the absence of any deposits among them which can legitimately be considered those of a deep sea. They have all been deposited in comparatively shallow water."

Conversely, the areas now occupied by deep sea have never existed as continents; in other words, the present ocean basins have been permanent. Mr. John Murray and M. Renard, in a recent paper before the Royal Society of Edinburgh, dealing with the deep-sea deposits collected by the "Challenger," conclude as follows:—"We have said that the debris carried away from the land accumulates at the bottom of the sea before reaching the abysmal regions of the ocean. It is only in exceptional cases that the finest terrigenous materials are transported several hundred miles from the shores. In place of layers formed of pebbles and clastic elements with grains of considerable dimensions, which play so large a part in the composition of emerged lands, the great areas of the ocean's basins are covered by the microscopic remains of pelagic organisms, or by the deposits coming from the alteration of volcanic products. The distinctive elements are, properly speaking, wanting in the great depths far distant from the coasts. . . . . . If it can be proved" (and the authors assert that it can, with the approbation of the leading geologists of the present day), "that in the sedimentary strata the pelagic sediments are not represented, it follows that deep and extended oceans like those at present existing cannot formerly have occupied the areas of the present continents, and, as a corollary, the great lines of the ocean basins and continents must have been marked out from the earliest geological ages."

Turning now to the subject of distribution, we find that it has two chief aspects—a statical aspect, in which the present distribution of plants and animals on the globe is

considered, and a dynamical aspect, where the causes which have brought about that distribution form the subject of enquiry.

The laws which govern the distribution of life on continents are naturally different in some respects from those specially applicable to the distribution of life on islands. It is with the latter that we are chiefly concerned.

Following Mr. Wallace, in his recent work on *Island Life*, we may classify islands as being either continental or oceanic, according as they have been separated from continents of which they are but detached fragments, or have originated in the ocean, and never formed part of a continent or any large mass of land. It will be necessary to indicate the leading points in which a truly continental differs from a truly oceanic island.

First, as to geological structure; continental islands are found to be always composed of stratified rocks of tertiary and secondary, and often of primary age, and exhibit formations which are identical with or have a strong resemblance to those of the neighbouring mainland, which, as a rule, is never far distant; on the other hand, oceanic islands, are generally at a great distance from a continent, and are always of a volcanic or coralline formation. Further, with regard to the surrounding ocean: that intervening between continental islands and the continent is shallow and narrow, while that separating oceanic islands from the continent is always profoundly deep and wide.

Devoting our attention then specially to oceanic islands, we find that they possess certain well-marked peculiarities in relation to their flora and fauna. The number of species and genera they contain is always much smaller than one finds on a continent; the species and genera are usually well defined and limited in range, often indeed occurring nowhere

else on the globe, whilst their relationships with those on the nearest continent are often exceedingly curious.

I have endeavoured in the following remarks to summarise briefly the facts known with regard to the causes which have brought about the present distribution of life on the Açores, which form perhaps the most interesting group of those islands entitled to the term oceanic, and have endeavoured to estimate the comparative influence the several causes have had in producing the anomalous flora and fauna of these islands. At some future time I hope to lay before the Society some further remarks relative to the origin of the flora and fauna of the Galapagos, S. Helena and other isolated peaks in the great oceans.

The group of the Açores, or Western Islands, lies between 25° and 30·15° west longitude, and between 36·5° and 39·4° north latitude. The islands are nine in number, and are divided into three groups—an eastern, a central, and a western. The eastern, which is 16° west of the coast of Portugal, consists of two islands—the larger S. Michael, the smaller S. Mary.

Terceira, Graciosa, S. George, Pico and Fayal form the central group; whilst the small islets of Flores and Corvo form the westerly division. In the aggregate they comprise an area of about 1,000 square miles, and contained a population in 1872 roughly estimated at 270,000. As might be inferred from the density of the population, the climate is healthy and the soil fertile. The coasts are steep and rugged, and the interior of the islands mountainous and wild — Pico, the highest summit, being 7,600 feet in height.

It is more important, however, at present to note the features which entitle these islands to be classed as oceanic.

1. They are far from any continent, the nearest point of the European mainland being about 900 miles distant

from S. Michael, while Flores is rather more than 1,200 miles from the coast of Newfoundland.

2. The ocean between them and the nearest continent is enormously deep, the soundings taken by *H.M.S. Challenger* varying from 2,000 to 2,800 fathoms.

3. They are almost entirely volcanic, the only stratified rocks being a salt water shell bed, belonging to upper miocene times, which occurs in S. Mary only. Volcanoes are extremely numerous, and the general appearance of the country is that of the district of Auvergne in central France. Hot springs and other evidences of the volcanic nature of the islands are abundant, and severe earthquakes are frequent. Pico is said to be still eruptive. Small islands often appear off shore, as, for example, in 1538, in 1720, and 1787, in which last eighteen small islets rose near S. George. So late as 1811 the island of Sabrina rose off S. Michael. The soil is formed by the disintegration of volcanic rocks, and is extremely favourable for the rapid growth of vegetation. The surface of lavas thrown out in 1672, 1718, and 1722 is now covered with cornfields.

4. The flora and fauna are peculiar, for whilst they present a characteristic absence of higher vertebrates, they show at the same time a very striking resemblance, both in plants and animals, to the forms at present inhabiting Europe.

The following is an abstract of the zoological and botanical characters of the islands.

First, as regards their fauna.

1. Only seven mammals are found wild, and these are all European. They consist of a species of rabbit, two weasels and some rats and mice of species found abundantly in Portugal. A bat, *vesperugo*, seems to be the only native mammal.

2. The birds are much more numerous, 53 species

being found, 50 of which are identical with those on the European continent.

3. Of reptiles, the Açores may be said to be destitute, one small lizard only occurring in Graciosa, probably not a native.

4. Amphibia are equally scarce, the only example being an eatable frog, which, although only recently introduced, is abundant in the central group.

5. Fishes also are comparatively wanting. Some of the little lakes in the old craters swarm with goldfish, also a recent introduction, but they are almost the sole representatives of the fish tribe. A curious statement with reference to these goldfish is made by many of the writers on the Açores, namely, that they are so plentiful that one cannot put one's hand into the water without touching them; and yet this statement is followed by another, that the goldfish die by thousands, and their dead bodies are thrown up on the shores all in a condition which plainly indicates that they have died of starvation, there being no food in these lakes for them. Their abundance under these circumstances would seem to be at least worthy of explanation.

6. The total number of species of insects has been set down at 212—176 of which are European, the other 36 are not found in Europe but occur in the other Atlantic islands, with the exception of 14, which are peculiarly Açorean.

7. The molluscan fauna is decidedly poor. Out of 69 species, 32 are peculiar to the Açores.

The flora of the Açores has been estimated as consisting of 478 species, of which all save 40 are European.

The question to be solved is, How came these plants and animals from the mainland to the islands, and how are we to account for these few exceptional forms found on the islands and nowhere else? The explanation proposed by Forbes, was that the continent of Europe, in past ages, extended in a

south-westerly direction, so as to include the Açores. The European character of the Açorean fauna and flora might thus easily be accounted for. After what has been stated with regard to the permanence of oceans and of continents, it is unnecessary to disprove the Forbesian hypothesis. What other agencies then have we left to account for the introduction of the present fauna and flora?

I think we may specify three:—

I. Oceanic currents.
II. Atmospheric currents.
III. Human agency.

I. What relationship do the Açores bear to ocean currents?

They are encircled by the south deflection of the Gulf Stream, after it has divided into the northern branch which does so much to make our climate tolerable, and the southern division which soon bends round again to form the north equatorial current. The speed of the Gulf Stream off the Açores is about ten to fifteen miles a day; the speed increasing to one hundred miles a day, or six and a half feet a second, at the Strait of Florida. On an average the daily distance travelled is thirty miles, so that fifty or sixty days at the utmost would be taken by any given particle of water to travel from the coast of Florida.

Now Darwin showed by a long series of experiments that seeds may be carried enormous distances by ocean currents. He found that seeds of many plants grew after a hundred days immersion in salt water, and concludes that on an average $\frac{14}{100}$ of the plants of any country could be carried a thousand miles by sea to another country, and when stranded on a favourable spot would germinate. One would expect, therefore, to find that at least the western group of the Açores should contain a number of American plants whose seeds had been so carried. The flora, however, includes

only five American plants altogether. That the Gulf Stream does bring a number of American plants to the Açores is certain. Don Josè Canto, a wealthy Portuguese settler on S. Michael, states that he has observed twenty species of American plants fall on the beach, and snuff-boxes are sold by the natives which have been made out of seeds of American plants cast ashore. If so many species have been noted by one individual on the most easterly island, and if we remember that Flores is four hundred miles west of S. Michael, I think we may conclude that the scarcity of American plants is due not so much to the rarity with which they have been carried over the Atlantic by the Gulf Stream, as to the unsuitability of the soil, or the rugged character of the shore on which they have been cast. No doubt also the seeds of plants growing in the lands bordering that part of the American continent past which the Gulf Stream rushes, are not specially adapted to sustain without injury so long an immersion in salt water.

Drift wood, also borne along by the current, would carry many seeds, and wood-eating insects or their larvæ. Indeed, instances are on record of West Indian seeds being cast ashore on the Hebrides and Shetland islands, which of course could not germinate in our climate.

Carcases of birds are mentioned as being a means of conveyance of seeds for long distances by sea. Some seeds taken from the crops of birds which had been steeping in salt water for thirty days, Darwin found still to retain their power of germination.

II. Next as to atmospheric currents, the Açores are said to be subject to two sets of winds, the E. and S.E. trades in summer, and the W. and S.W. return trades in winter. From an examination of various logbooks of vessels passing over the seas between the Açores and the mainlands of Europe and Africa, I find that, taking an average of

several years, the direction of the winds was decidedly westerly, and all the heavy gales I noticed were W. or S.W. Even in summer, the winds seem to be as often west as east, and in no case did I notice, for the last few years at least, any strong gale from the east similar to the western hurricanes of winter. I draw attention to this, for I think too much stress has been laid upon the influence of N.E. gales by Mr. Wallace and others to account for the present distinctly European insect, bird, and plant population.

In treating of the Açores in *Island Life*, Mr. Wallace writes:—"There is one conclusion to be drawn from the almost wholly European character of the Açorean fauna and flora which deserves special attention, namely, that the peopling of remote islands is not due so much to ordinary and normal as to extraordinary and exceptional causes. These islands lie in the course of the S.W. return trades and also of the Gulf Stream, and we should, therefore, naturally expect that American birds, insects, and plants would preponderate if they were conveyed by the regular winds and currents, which are both such as to prevent European species from reaching them. But the violent storms to which the Açores are liable blow from all points of the compass; and it is evidently to these, combined with the greater proximity and more favourable situation of the coasts of Europe and North Africa that the presence of a fauna and flora so decidedly European is to be traced."

It is true that the Açores are subject to violent storms, but these are for the most part local; and it is obvious that a local hurricane could in no way assist the passage of any seed, bird, or insect from the European coast. Besides Mr. Wallace's deduction proves too much; for the "favourable situation of the coast of North Africa," combined with these tempests, even supposing the wind to be continuously easterly from the Coast of Africa to the Açores, a distance

of over a thousand miles, has succeeded in introducing only one African plant, as shown by Mr. H. C. Watson's lists in Godman's *History of the Açores*, notwithstanding that the Canaries and Madeira might act as stepping-stones for their transit.

Again, sixty-nine species of American birds are found in western Europe, which have, according to Darwin, probably been driven out to sea by some gale, and with the assistance of ships succeeded in crossing three thousand miles of ocean, and yet no European bird is found in America, save a few which have entered by Iceland and Greenland. If, however, birds are able, with the assistance of vessels to get halfway across, *i.e.*, to Flores, by means of hurricanes, it seems strange that they should not succeed in crossing entirely.

III. Writers on the Açores could scarcely help seeing that man had had an important share in introducing both plants and animals into these islands. I am disposed, however, to lay far more stress on this factor than has hitherto been done.

The Açores are mentioned by Edrisi and Vardi, two Arabian geographers; but, although marked in a map in 1356, it was not till 1432 that Cabral, a Portuguese admiral, took possession of the island of S. Mary in the name of Portugal. All the islands were known by the year 1457, the term Açores being then applied to them on account of the number of "hawks" found on them. The first discoverers probably mistook the Açorean buzzard for an "açor" or hawk.

They were soon colonised by the Portuguese. An influx of Flemish settlers took place in 1470, and from 1580 for sixty years the islands were under Spanish rule. Since then they have been a colony of Portugal, to which country alone the inhabitants were for many years compelled to confine their trade.

All the mammals, many of the birds, the reptiles, amphibia and fish, have been directly brought into the islands by man; and a very large proportion of the insects, in fact, almost all the European forms are such as might easily be introduced in the ordinary traffic with the mainland. Four hundred out of the four hundred and eighty species of plants we have seen also belong to south-west Europe. We have further seen evidence to prove how rapidly a soil is formed even upon recent lava beds, and how excellent that soil is. At the present moment plants from every quarter of the globe are artificially cultivated there. The climate is very mild; the mean annual temperature being 63.8° F. When first discovered these islands were completely clothed with a native forest and underwood, but immediately on their colonisation, orange-trees were introduced from Portugal, and the cultivation of that fruit was carried on to such an extent, that in a very short space of time the whole of the native wood was exhausted to afford material for orange-boxes, and the space so cleared was covered with orange groves. So great was the scarcity of native timber and shrubs that the deficiency had to be supplied from Spain and Portugal, and shiploads of young trees were imported to afford protection to the more delicate orange-trees, and furnish wood for the manufacture of boxes. Knowing, from Mr. Darwin's patient researches, how great a number of seeds and organisms may be borne from one country to another in little cakes of earth attached to a bird's foot, and carried in the cracks of floating timber, we cannot, I think, but admit that here we have the all-sufficient cause of the European character of the flora and fauna of the Açores; and that it is to this fact and the subsequent limitation of trade to Portugal and its colonies (thus accounting for the presence of one or two Brazilian species), and not to the exceptional gales or atmospheric currents that we must

attribute the peculiarities in the distribution of life on these islands; while the absence of African forms is at once explained by the fact that no similar trade existed with that country. Further, the European character of the flora and fauna is now maintained by the constant traffic between the Continent and the islands in the transport of the fruit for which the Açores are so famous.

The gradation in number of the species from the eastern islands westwards, made so much of by many writers, may of course be explained by the fact that they were discovered in that order, and also the traffic is greatest with the more eastern islands; communication is only monthly, in fact, with Flores and Corvo, sometimes less frequently.

In conclusion, I am inclined to think that the original life on these islands had probably a strong resemblance to that of America, although, perhaps, their recent origin, and the physical conditions then obtaining there, prevented that flora and fauna from being of any great extent. As glacial times arrived, not only would the American plants and animals disappear, but, owing to the fact that the equatorial current would no longer split into two parts on the Cape of S. Roque, the Gulf Stream would cease to flow, and thus one important agency of American immigration would have been removed. Further, the icebergs which stranded on the Açorean shores, and which have now left as erratic boulders, "the large fragments of granite and other rocks, which do not occur in the Archipelago," no doubt, as Mr. Darwin says, "partly stocked these islands with ice-borne seeds," which they had gathered in their northern and European homes, remnants of which, it is possible, may exist in the evergreens peculiar to the islands. On the recurrence of warm conditions and the return of the Gulf Stream, I think it more than likely that the fauna and flora partook again, at least partly, of an American character, and we have no evidence to prove that

it was not so, since no records are extant of the original nature of the flora and fauna when the Açores were first discovered; and I further believe that this primitive life has been entirely obliterated, partly, perhaps, by volcanic outbursts in the interior, but more especially by the introduction, as we have seen, of European plants and animals by human agency; and that the ease with which these have established themselves explain why they are now so abundant, and why they have killed out the original population and any American forms that may have been, from time to time, washed ashore.

I am indebted for much information to Mr. A. Hoffnung, of London, Mr. F. Hepburn, of Sutton, Surrey, and to Rev. C. Watson, of Cardross. I desire also to return my thanks to Mr. Alex. Sinclair, Liverpool manager of the African Steam Navigation Company, for permission to consult the logbooks of the steamers of that line.

THE REFORMATION IN ITS RELATION TO ENGLISH LITERATURE.

By Rev. S. FLETCHER WILLIAMS.

It is an utter mistake to suppose, as some modern historians do, that the English Reformation in the sixteenth century was a royal caprice, a political act, viewed with indifference by the nation. The English Reformation was the result of the convictions and deliberate resolutions of the wisest and best; it sprang from the influence of religious truth upon the consciences of men. Its opponents did not attribute it to political causes. *They* found martyrs ready in numbers to seal the truth with their blood long before Henry VIII gave his adherence to it; and they declared that the inexplicable stubbornness of the Lollards, the Psalm-singers of old, had returned upon England with tenfold force. So far, indeed, was England from being the only nation which looked upon Church reforms with indifferent acquiescence, that nowhere can these reforms be proved to have met with more lively and general interest and sympathy.

But while this is undoubtedly true, it must be understood with limitation. The heart of the nation was with the reform movement, but could do little more than beat in sympathy. Although the numbers and the influence of the middle-class greatly increased during this reign, yet its existence as a power in the State must be referred to a later period. By a rare combination of circumstances, however, we are enabled, at the Reformation, to trace the history of the masses in that of the kingly power; and here we have the origin of that vulgar error of attributing solely to the kingly power the success of a movement which engaged the

attention of all classes alike. At that time the interests of the king and those of the people were singularly united. The wars of the Roses, succeeded by the cautious and proscriptive policy of Henry VII, had effectually broken the power of the nobility. The age of the king-makers, of all-powerful coalitions on the part of the aristocracy, had passed away for ever; and the new element of democracy, destined one day to crush royal prerogative in England, was rising in the social world, fostered and patronised by royalty itself. Nearly all the acts of the Tudors, intentionally or not, had a tendency to develop this new power; for the suppression of the great houses, by whatever means, became a traditional policy with them. Never were English sovereigns so absolute as from Henry VIII down to Elizabeth; but then, it must be added, never were they so popular. Hence it will be seen that the Court fairly represents, on the whole, the activity of the nation at the time in question. And this idea must never desert us. I may add to the Court the Universities, which were the scenes of strong reformatory agitation, and which witnessed the preaching of Latimer, the lectures of Sandford, and the disputations of Cranmer. In the history of these centres of influence may be found the history of a movement which was almost simultaneous with the revival of learning, and always enlisted in its cause the most learned men, as well as the most honest thinkers. Nothing, in fact, is more noticeable in the Reformation than this, that the Reformers were all men of learning. The history, therefore, of learning at the time, and some estimate of its results, will claim our first attention.

About fifty years before had occurred the catastrophe of the Turkish capture of Constantinople. That event scattered the whole Greek nation over Europe. Their noble literature, after an absence of about seven hundred years, thus suddenly re-appeared. It created everywhere new habits of thought,

and introduced an unknown accuracy of expression. The influence of Greek was soon felt in England. Fox, the founder of Corpus-Christi College, and Wolsey, of Christ Church, instituted lectures in it. They were the first to break through the system which had confined the student to scholastic philosophy and the acquisition of a bald Latinity. Erasmus, on his first visit to England, at the close of the fifteenth century, met with a select circle of scholars devoted to the newly found language,—Grocyn, Linacre, Latimer, and, above all, Thomas More, of whose genius and acquirements he speaks in terms of friendly hyperbole. Already were the volumes of Plato unrolled; already was the cry *Græcum est, legi non potest!* waxing fainter along the college cloisters, when the Reformation came on. Its first effects were not favourable to the study of the classics, which were abandoned for the time by both Romanists and Reformers.

Among the Romanists, Greek authors, and, I may say, the majority of Latin authors, lost the support of the higher clergy, and, with them, of the whole body of ecclesiastics. At first, Greek had received the enthusiastic support of the Pontiffs themselves, but it was soon perceived to lead to innovations in religious belief, in philosophy, and in politics, by no means consistent with the established order of things. Accordingly it encountered the most violent and universal opposition; and *Græculus iste,* originally applied as an epithet of contempt to Erasmus, soon became synonymous with "heretic."

On the other hand, while the Reformers adopted in theory what their adversaries rejected, their immediate attention was directed to patristic theology for a solution of the various questions at issue, and little leisure was left them for admiring the turn of a sentence, or the emphasis of a particle. They were, however, fully conscious of the

importance of an accurate knowledge of Greek. Erasmus corrected numberless corruptions of doctrine by restoring the right reading of passages upon the authority of codices; and Melanchthon declared that *optimus grammaticus optimus theologus*. Innumerable institutions were founded which insured the future cultivation of the language; and the fact that many questions of religious belief were involved in a knowledge of it, rendered the revival of learning in the sixteenth century far more extensive than it would have been had scholarship been merely a matter of taste.

There were several men — Smith, Cheke, Haddon, Ascham, Udal, Lilly — who, although more or less actively engaged in the controversies of the day, achieved a simply literary reputation. These did their best to diffuse a love of philology among the students who attended their lectures; but, notwithstanding their efforts, the progress of that science and of ancient criticism, which has occupied almost exclusively the attention of modern scholars, was slow. The study of languages was seldom, in the sixteenth century, a primary object. Books were few, and, after the abolition of the monasteries, no public library of any magnitude appears to have existed. Hallam states that before 1550 only two books instrumental to the study of Greek appeared in England. Nor were these augmented at the end of the century, save by a few trifling publications, principally on grammar. In Latin, we meet with no work more than rudimentary. The only one that has at all maintained its ground is Lilly's school-famed Latin grammar, to which Wolsey himself condescended to write a preface. The editions of Latin classics published in the realm scarcely amounted to a dozen.

But we should arrive at a conclusion rather below the truth, were we to form our estimate of the state of classical literature from the number and the quality of the books published. There were many men not unacquainted with Greek,

for instance, who did not devote themselves to criticism or philology. Such were Pace, Tunstall, Gardiner, and Tyndale. The editions of Rome and Paris were eagerly sought after; much learning was acquired and perfected by foreign travel; and much was imported by the learned strangers who, headed by Erasmus, made England their home in the early part of the century. In the absence of proper aids, the cultivation of Greek must have been extremely arduous. It was, however, introduced into several of the public schools, and Hallam thus describes the process:—"The teacher provided himself with a lexicon, which was in common use among the pupils, and with one of the grammars published on the continent, from which he gave oral lectures, portions of which were transcribed by each student. The books read in the lecture-room were probably copied out in the same manner, the abbreviations giving some facility to a cursive hand; and thus the deficiency of impressions was in some degree supplied, just as before the invention of printing." To this laborious process, doubtless, is owing that immense verbal memory which astonishes us in the great scholars of the sixteenth century, and in which they have never been equalled. A great amount of exact and curious information, too, was preserved in the *adversaria*, or "common-place books," which it was the fashion among scholars of that day to keep.

The Latin language, as written at this time, is far from presenting that high state of classical finish of which the productions of modern scholars furnish such exquisite specimens. It was then not so much an accomplishment as an indispensable acquirement—a spoken, a living language, subject to the fluctuations of colloquial use. In it were conducted the most important transactions; in it were drawn up the most minute statistics. Therefore the classic purity, which it has since cost so much to preserve, was con-

taminated by barbarous phraseology and foreign idiom. The Italian mania of Ciceronianism, which has since been equalled, did not *then* obtain in England. Our Latinists seem to have considered the language as their own property, as a means by which they might express their thoughts to the greatest number of readers; and, provided they attained their object, they cared little for Ciceronian phrase or rhythm. But there were two or three Englishmen who paid most scholarly attention to their Latin style, among whom must be counted foremost Sir John Cheke, who, indeed, took the lead in every branch of learning. The famous Latin orations of Walter Haddon are remarkable for a certain florid redundance belonging neither to the chaste Ciceronians of Italy, nor to the more original followers of Erasmus, but rather formed on the model of the later Romans. Ascham's Epistles—of which, as Public Orator of Cambridge, he wrote a vast number—are more favourable specimens of easy and fluent Latinity. The Latin poetry of this period was something like that of Isaac Barrow, full of thought and force, but often execrable in prosody. It, as well as the prose, possesses that originality which is so killing to classic grace.

The course of study pursued in the Universities may be understood from a letter of Ascham's to Cranmer:—"For oratory they plied Plato and Aristotle, from whose fountains among the Greeks prudence of speech might be fetched; and to these, among the Latins, they added Cicero. They were versed also in Herodotus, Thucydides, and Zenophon—the three lights of chronology, truth, and Greek eloquence, and which brought also a great lustre upon their other studies. The Greek poets which they took delight in were Homer, Sophocles, and Euripides; the one the fountain, the other two the streams, of all eloquence and learned poetry."

Still, the state of the Universities does not always give

the true criterion of the condition of learning. In the present case we must look for it to the Court. At that time great attention seems to have been paid to the education of Princes. In no respect was the wisdom of Henry VII, the English Solomon, more manifest than in the careful training bestowed upon his children. Henry VIII, when quite a boy, had written a Latin letter to Erasmus, from his own resources and in his own handwriting. He was a diligent reader of Thomas, "the angelical Doctor," and dared to enter the lists of controversy against Luther himself. And Henry took care that the benefits of education should be transmitted to his own children. Edward VI wrote Latin exercises and letters of such eloquence as to create suspicion among modern historians that he received tutorial aid in their composition. They argue a mind of great precocity in acquiring knowledge, and a deeply reflective disposition. His interview with the celebrated Cardan, as related by that philosopher, is the testimony of a foreigner to the learning and intelligence of the English prince. Edward's sisters, the ladies Mary and Elizabeth, were of nearly equal attainments with himself. Mary understood five languages—Latin, Greek, French, Italian, and Spanish; Elizabeth was even superior to her sister, and particularly eminent as a Grecian. Ascham has left a glowing account of her quickness and understanding; and her learning must have been considerable as, when she was Queen, she harangued the Universities in Greek. Many other instances of learning among court ladies occur. Foremost of the group stands the beautiful Lady Jane Grey, whose noble and gentle mind, rich accomplishments, and cruel fate make her one of the sorrows of history. The Countess of Pembroke read Pincer with Ascham; Lady Cecil and Lady Russell were distinguished scholars; Anne, daughter of Sir Anthony Cook and mother of the great Lord Bacon, translated the *Apology* of Bishop Jewell from the

Latin, and the Sermons of Ochino from the Italian; and her four sisters were as equally accomplished as herself.*

The literary fame of Henry VIII and his children rendered the Court at this time the audience chamber of the learned, both of England and the continent. Numbers of learned foreigners—the distressed in circumstances, the persecuted for opinion—were attracted by it to the palace, there to be retained, or thence to be distributed over the country into situations where they might be of service to the republic of letters. Erasmus, the king of the schools, Peter Martyr, and Martin Bucer, men of European reputation; Fagius and Tremellius, the greatest Hebraists of their time—all taught in our Universities. Ochino, Menius, Alexander, Jonas, Dryander, Lasco and Sleidan the historian, are among the names of those who thus found a home in England. The famous Italian, Polydore Virgil, spent the greater part of a long life in the country which his history so unfairly traduces. Cranmer appears to have been the leading patron of these learned strangers. At his invitation they came, and he provided for them on their arrival. At one time he entertained seven of them together in his house.

It is, in truth, scarcely possible to overrate the influence of the court upon both learning and literature. We must bear in mind what I have already stated of the *popularity* of the Tudors. The court was, in fact, the reading public of the sixteenth century. Despotic in act, our sovereigns were still always ready to listen to the most liberal sentiments and theories. Erasmus, author of the *Adages*, a work unsurpassed in the bitterness of its strictures upon kings by any

* It was pre-eminently the age of learned ladies. Harrison says:—"Truly it is a rare thing with us now to hear of a courtier which hath but his own language. And to say how many gentlewomen and ladies there are that, besides sound knowledge of the Greek and Latin tongues, are thereto no less skilful in Spanish, Italian, and French, or in some one of them, it resteth not in me."

seditious modern print, was yet honourably received by the tyrannical Henry VIII. Sir Thomas More, notwithstanding his bold censures in *Utopia* of the vices of power, was long one of the most favoured courtiers of his day. It was the delight of Edward VI to sit for hours listening to the long sermons of the Reformed Divines, who by no means confined their discourses to spiritual themes, but, like the prophets of old, took every occasion of inveighing against the political and social abuses of the age. It was not to Parliament, but to the king, that the people looked for the redress of their wrongs; and it was before the king that they laid their memorials. This reciprocal action of the Court and the people is most interesting and important. The Reformation appealed to the people, and the people made the Court become the means of verifying the enthusiastic aspirations kindled by the Reformation. The example of royalty infused into the nobility a love for literary pursuits which has seldom been equalled, and this made them the organs of the united will of both king and people. It would be impossible to mention all in the royal household or in Government offices who distinguished themselves by literary performances. Suffice it to say, that the continuous succession of English poets begins from Sir Thomas Wyatt, the Earl of Surrey, and Lord Vaux, that "company of courtly makers;" and that the fathers of English prose are Sir Thomas More and Sir Thomas Elyot. And thus arose the majestic form of English literature, instinct with the life of the people, adorned and robed by the hands of nobles as to meet the eyes of kings.

An important event in the history of learning in this country was the abolition of the monasteries. I shall not inquire whether this was an act of political wisdom or of arbitrary folly. I shall merely observe that there is indubitable evidence that, long before this time, the various

orders had lost their hold on the minds of the people, and that the measure was acquiesced in. Opinions, again, have been divided as to its effects on classical learning. I cannot think, with some, that it was unfavourable; nor do I anticipate that the more consistent opposers of the abolition of the monasteries will dispute this position. Monkish learning is not classical learning; and the presence of the one, so far from promoting the other, is a hindrance to it. Whatever classical learning might lose by the destruction of the monastic schools has been well compensated by the numerous foundations, in the reign of Edward VI, of free grammar schools, which may rank among the most beneficial institutions of any age or country, and which have been indicated by Coleridge as the great preservers of "sound book-learnedness" and sober philosophy.

A far more serious evil was the almost total destruction of the conventual libraries. This is lamented by contemporary writers as altogether irreparable. Treasures were then ruthlessly wasted which far exceeded the Alexandrian Library in number and the Vatican in rarity. About the year 1550, the Council Book mentions the "purging" of the King's Library at Westminster from all superstitious books. A similar fate overtook the Oxford libraries the same year from the King's Visitors. Merton College suffered severely, a whole cartload of manuscripts being carried off and thrown away. Balliol, Exeter, Queen's and Lincoln were almost equal sharers in calamity. The barbarous process is thus described by Jeremy Collier:—"The books marked with red, or with a cross, were generally condemned, at a venture, for Popery; and where circles and other mathematical figures were found, they were looked upon as compositions of magic, and either torn or burnt. And thus an almost inestimable collection, both for number and value, was either seized by the Visitors and turned into

bonfires, or given to binders and tailors for the use of their trade." *

No such fate could be wrought by its opponents on what is familiar to us as at once infinitely the most valuable fruit of the revival of learning, and the first step of Church Reformation—I mean the Greek Testament of Erasmus. In taste, in wit, in learning, Erasmus stood high above his contemporaries; and his Greek Testament is alone sufficient to place him in the foremost rank of the Reformers. In controversy, his name has been eclipsed by his bolder successors, but the results of that method of Scriptural study and interpretation which he inaugurated have been more lasting than those of controversy. I do not share in the futile regret that the Reformation did not take an Erasmian rather than a Lutheran character; but I claim for Erasmus, for Colet, and for More that in the critical or historical study of the Scriptures which they promoted, in the emphasis with which they enforced the simple truths of practical Christianity, in the opposition they gave, not only to past forms of scholasticism, but to the technical, argumentative and controversial spirit which underlay it, they set in motion forces which are not only not yet spent, but which have a greater part to play in the evolution of the theology of the future than ever before. If it were noble of Erasmus to produce a work which was a daring innovation, as well as a marvel of critical research for its time, it was no less noble to urge

* Referring to the check given to the cause of classical learning by the destruction of Greek and Latin manuscripts from the conventual libraries, Mr. Marsh says :—" This short interruption, so far from proving injurious to the improvement of the English language, was rather a benefit to it; for it put a temporary stop to the influx of Latin words, which were threatening to overwhelm the Anglo-Saxon vocabulary; and before the study of Greek and Latin came again into vogue, English had gathered strength enough and received sufficient polish and culture to be able to sustain itself as a literary dialect against the encroachments of ancient or foreign philologies."—*Origin and History of the English Language*, pp. 524-5.

what was then an even more daring innovation, and what demanded scarcely less critical knowledge. He pleaded that all classes might have the Scriptures within their reach. "I wish," he said, "they were translated into all languages, so as to be read and understood, not only by the Scotch and Irish, but even by Saracens and Turks. I long for the day when the husbandman shall sing parts of them to himself as he follows the plough, when the weaver shall hum them to the tune of the shuttle, when the traveller shall while away with their stories the weariness of his journey."* The bold opinion of Erasmus was soon followed by its realisation. Nothing in the history of England is more affecting than the struggles and difficulties of William Tyndale, the poor scholar, during the prosecution of his great design. I cannot stay to trace it. I hold that it is mainly to the New Testament of Tyndale that the Reformation in England owed its universality and its living faith.

* The New Testament of Erasmus crossed the channel from Basle in 1516. It is not probable that the timid scholar foresaw all the incalculable consequences of his work. He had seized, as he thought, a favourable opportunity for quietly introducing an acceptable offering to the learned world. But immediately the work was in every hand. "Men struggled to procure it, read it eagerly, and would even kiss it." Never had any book produced so wide an agitation. Erasmus, seeing that a great work was to be done, had looked for the support of all who loved the Christian Church, and professed to be followers of its Founder. But traditionalism was stirred up from its lowest depths. He met with opposition and hatred from men of the old school, and especially from the monks and scholastic divines. To them the old Vulgate version was sacred, and Greek a heretical tongue. Regular and secular, in terror for their ancient common, vied in their attempts to arouse the populace against the great work: the priests thundered from their pulpits; the monks went about "among susceptible women and credulous men." Erasmus stood aghast. "Who," he cried, in despair, "could have foreseen this horrible tempest?" But his New Testament went through several large editions, and when, a few years after, the learned men of the Sorbonne at Paris complained of what they called its heresies, Erasmus was able to reply triumphantly, "You are too late in your objections. You should have spoken sooner. It is now scattered over Europe by thousands of copies!"

During his labours upon the New Testament Tyndale had the occasional assistance of Fryth, Bilney, and others eminent in the history of the times. His first edition appeared in 1525; and it was not till 1529, after he had already, with the aid of Luther's German version and the Vulgate, begun upon the Old Testament, that he met with Coverdale at Hamburg. The latter was a man of like spirit—ardent, faithful, and courageous. He had already been engaged in the same undertaking in England, under the patronage of Cromwell, who had a precious collection of the necessary books. The two Reformers agreed, after many conferences, to work separately, but to unite the result of their labours. In 1535 appeared Tyndale and Coverdale's Bible—the first complete version of the Scriptures into English, except the now obsolete one of Wycliffe. It is admirable for propriety, perspicuity, and accuracy, and it was closely followed in the Authorised Version. Its literary effects were as great as its spiritual. Like its successor, like every book which has obtained a universal circulation, it arrested and stamped into permanence the fleeting forms of spoken language.*

And here I pause a minute to ask myself the question, What was the true literary tone of the Reformation? Hallam states (1) that the great religious schism absorbed

* "Tyndale's translation of the New Testament is the most important philological monument of the first half of the sixteenth century, perhaps I should say of the whole period between Chaucer and Shakespeare, both as a historical relic, and as having more than anything else contributed to shape and fix the sacred dialect, and establish the form which the Bible must permanently assume in an English dress. The best features of the translation of 1611 are derived from the version of Tyndale, and thus that remarkable work has exerted, directly and indirectly, a more powerful influence on the English language than any other single production between the ages of Richard II and Queen Elizabeth."—G. P. Marsh, *Lectures on the Eng. Lan.*, 4th edit., p. 118. See also *Ibid.*, p. 171 and p. 625. See the same author's *Origin and Hist. of the Eng. Lan.*, p. 505.

all the learning of the day in theological controversy, and (2) that classical studies were no longer pursued for their own sakes, but chiefly with reference to the grammatical interpretation of the Scriptures. With respect to this latter charge, I am as willing to admit it as Mr. Hallam was to enforce it. I admit the Reformers did consider that the chief value of the great language of antiquity was, that it contained the New Testament; and that the most important office of criticism was to elucidate the text of the Gospels and Epistles. I admit that they did not worship the great authors of antiquity, but they admired those authors, and made ample provision for the study of them. I admit they did not dream that the time was coming when the education and the genius of each century should be judged by the classicalism of its Latin prose and the prosody of its Greek verse; when the acquisition of structural skill in the languages of the *Æneid* and the *Agammemnon* should be thought worth years of toil, and, as a necessary process, be undergone by all who would claim to be considered educated; when the productions of the classic muses, valuable as exhibiting the workings of minds akin to the mind of modern Europe, and affording a starting-point to the course of modern literature, should be looked upon as examples of excellence unattainable by men of modern mould. No; the Reformers did not dream of all this, and whatever blame attaches to them for not dreaming of it, I freely admit. But, on the other hand, I maintain that we owe it to the vigorous elements of thought and freedom which the Reformation introduced that the flood of classicalism did not submerge our literature a century sooner than it did. What, for instance, prevented the learning of Milton from warping his genius, and rendering him no more than a second Virgilian moon to the Homeric sun, but the strong Hebrew element which is fused with his poetry?

Mr. Hallam's other charge—that the learning of the day was absorbed in theological controversy—is scarcely open to question. It is true that when persecution was over, works of controversy were multiplied; endless and fruitless discussions were carried on, both between the Reformed and Roman churches, and between the Reformers themselves, on the Eucharist, the nature of justification, and the extent of salvation. Lutheranism and Calvinism held an unrelenting internecine war. In the latter part of the reign of Henry VIII, and in the reign of Edward VI, may be marked the origin of sectarianism. It is to be profoundly regretted that the quarrels of the Reformers, carried often to intemperate lengths, did infinite injury to their cause. As I read the history of theology and of ecclesiasticism, nothing has been so clearly established by it as the uselessness of polemics as a means of producing religious conviction. What is matter of religious belief cannot usually be made amenable to reason; it falls under the jurisdiction of another faculty—that of intuition; and argument, proof, logic, rhetoric, sarcasm have invariably failed in expelling what the mind has in this way perceived, or is convinced it has perceived. For instance, the absurdity of the doctrine of transubstantiation, it has been well remarked, struck the minds of the Reformers of the sixteenth century as forcibly as it has struck any Protestant since; yet all the tomes which the sixteenth century produced upon the subject, all its canons of scriptural interpretation, all its authorities, all the weapons of its logic, left unmoved the belief of Sir Thomas More, the acutest thinker of his age; and transubstantiation found in him an unreluctant martyr. In effect, your polemic always starts with begging the question. He frames his logic, constructs his categories, and assumes the falsity of whatever does not fall within these self-invented conditions.

The career of Cranmer is commensurate, as far as my

scope extends, with the war of opinions which prevailed during and after the adjustment of Church and State. No historical character has been more decried, none more lauded, than Cranmer. By some he has been denied all talent; by others all principle. He has been alternately represented as a fool, as the puppet of circumstances, as the fortuitously great, and as a hypocritical time-server, without either courage or honesty. On the other hand, this greatest name in the English Reformation has been almost deified by his admirers. No spot, no fault, no inconsistency is allowed to have had existence in his character, conduct, or writings. As usual, the truth lies in the mean. Cranmer was neither fool, knave, nor demi-god. He lived in an age when men had need of all the tact they could muster, and he proved himself prudent and learned. He was one of those useful persons who sometimes acquire influence by the very absence of striking and ardent qualities—the Melanchthon of our English Reformation. The greatest defect of his character, want of firmness, which has ruined many a man of genius and learning, by a peculiar combination of circumstances secured his advancement and guided him to fortune. His mind possessed great acuteness; he could generally perceive what was best, although, had vigorous action been required of him, he would have failed to do justice to the clearness of his views. Such a mind is common enough. Fortunately for the usefulness of Cranmer, the time required of him little more than to follow his bent and be moderate. He was surrounded by vehement and excited spirits, who required all the restraint of his temperate and quiet character. And these very traits of his have impressed upon the Church which he moulded, and upon the public office which he, as Primate, had the chief share in drawing up, a noble and dignified moderation, a just and wise tolerance which has never been lost. It is through Cranmer's influence that the

Church of England, at the present day, shelters at once the High and Low Churchman, the Universalist and the Calvinist, the Rationalist and the Traditionalist.

The literary character of Cranmer was of great merit, for the time in which he lived. His writings shew him to have been a man of extensive research, and of prompt judgment in applying his learning. Disputations and controversial treatises on the Eucharist comprise the greater part of his remains, and these exhibit much acuteness and ingenuity of thought, clearness of distinction, and aptitude in exposing the weak points of his adversary's argument. They may be taken as a fair sample of all the polemic works of this age. In all are to be found the same nicety of distinction and arrangement, the same scholastic subtlety of argument, the same reliance upon patristic authority, the same redundancy of quotation.

The greatest theologian, and probably, next to Cranmer, the most influential character of the English Reformation, was Bishop Ridley. His merit, relatively to Cranmer and Latimer, is thus determined by one of his most eminent adversaries: "Latimer leaneth to Cranmer, Cranmer leaneth to Latimer, and Ridley leaneth to his own singular wit." This is so far true that Ridley, while in learning he is superior to the other two, is free from the harshness of the one and the indecision of the other. He is not what the controversialists of his day too often became, a mere intellectual machine, colligating, dividing, inferring, and only giving evidence of human sensations by occasional sarcasm and invective. There breathes through his writings a pathos and tenderness which could only have accompanied profound feeling. His mind was a rare union of several high qualities; his thoughts are remarkable both for force and acuteness; but what most distinguishes him from his contemporaries is his fulness of sympathy, gentleness, and

sensibility. The truly great must be great in heart as well as in mind. In Ridley severity, manly seriousness, and depth of thought are tempered by the noblest love for humanity, the softest compassion for human sorrows and weaknesses. His are almost the only theological works of the time in question which have, in any considerable degree, taken hold on the public mind. Had his sermons survived, they would have been the most interesting and valuable of the age.

Is it to be regretted that these elder champions of a long war swallowed up their intellects in the vortex of controversy? Yet these things must be remembered: (1) That this war of tracts and disputations, with whomsoever conquest lay, effected an immense progress in mental activity, and the impulse given by it communicated itself to every branch of science and letters, as the wave which washes one spot breaks at the same time along the shore; (2) that it handled questions which then concerned the very life of the Church and the nation;* (3) that it produced writings wherein, notwithstanding their deficiencies, are qualities which mark the embryo of a great literature. The thoughts are generally sound, equal, and laboriously worked out; there is no glancing at a topic, but everything is minutely investigated. There is no dishonour about them, no false graces, no feeble expression, no artificial conceits. In their massive sentences there is a fulness of meaning, resulting from stern truth of intellect; often, that sort of pathos which lies in sincerity and earnest conviction. The excitement of controversy imparts to some of them

* "At that period of universal religious excitement, the study of theology was, to the man of liberal culture, just what the study of political history and public economy is in our day—a necessary complement to the special learning required for the exercise of his particular profession, or the performance of his general duties as a member of the body politic. Every man of education, every man who read at all, in fact, read theological books."—Marsh, *Origin and Hist. of the Eng. Lang.*, pp. 506–7.

great spirit, which is heightened by the continual recurrence of forms of interrogation, and the close grappling, paragraph by paragraph, almost dialogistically, with an adversary's arguments. Certainly, no one of our polemic authors succeeded in creating for himself a distinct style. They express similar views upon similar subjects in a manner similar to one another. Each sentence is a slow, solemn, encumbered march, the meaning weighing down the words, much as heavy baggage and equipment exhaust an army in motion. Much of this may be accounted for by the youth and poverty of the language. Those turns of expression, those delicate shades of meaning, on which mainly depends the charm of a modern style, could then have no existence. Words had not acquired fixed and definite significations, had not come to symbolise complex conceptions, nor to call up associative trains of thought; technical terms were few, and much had to be expressed by periphrases which is now contained in a single word. On the other hand, we are guaranteed in these writers from what, for want of a better word, we call *slang*—the bane of modern literature. I mean the carrying to excess of the facilities afforded by the associative power of words; the strained, yet slovenly, efforts to produce effect by a certain selection or a certain sequence, which disgusts us in so many writers at the present day. These, for the most part, are but desperate attempts to appear easy and graceful in borrowed attire. Of course, the only way to write well is to think clearly and vigorously, yet how often do we now find artifices of verbiage put in place of clear and consecutive thought! It is better that men should express themselves unskilfully and strongly than that pathos and seriousness should be sacrificed to flippant, self-conscious adornment. The men of the sixteenth century were not *literati;* they wrote for their own generation, not for all time; they aimed at expressing their

meaning tersely and simply; and their attraction lies in this undivided purpose. Is there, as I have said, little individuality, either of style or thought, to be traced among them? Yet I cannot forget that they did much for letters: they adopted a homely speech which became the religious movement that kindled the mind of England; they gave to it a classic grandeur from the very thoughts they used it to express; they reared it at once into the language of England, and if they wrote it with none of the finished grace of a later day, they still wrote it as men who were so full of fresh and strong thought that beneath all the stiffness and rudeness of style we see the power of the original English mind.

The few books belonging to the first part of the sixteenth century unconnected with theology, which have come down to us, may be dispatched in brief. Sir Thomas More's *History of Edward V, and of his Brother, and of Richard III*, was written about 1509, and it appeared anonymously in Grafton's edition of Hardynge's *Chronicle*, printed in 1543. It is a work worthy of the noble genius of its author, and may still be regarded as a model of perspicuous and effective narration. It has been praised by Hallam for its English, "well-chosen, and without vulgarism or pedantry," and is about the first prose work which can lay claim to such praise.* Sir Thomas Elyot's *Governor* (1531) is the pro-

* Hallam's *Lit. of Europe*, 6th edit., vol. 1, p. 454.—It is "of doubtful historical value, but of great philological importance, as the best English secular prose which had yet been written." "The excellence of its style," says Marsh, "is such as an Englishman in that age could have attained only by a familiar acquaintance with the more advanced diction of the theological literature of the English language. This acquaintance More certainly possessed in a high degree." "In the *Life of Richard III* More seems to deserve the praise so often bestowed upon him as one of the first great English prose writers."—*Orig. and Hist. of Engl. Lang.*, p. 502–3. "The best example of original English of that period."—Marsh's *Lec. on Engl. Lang.*, note on p. 125. Marsh estimates that More's vocabulary, in this work, is eighty-four per cent. Anglo-Saxon.

duction of a man of sagacity and learning, and a courtier. It professes to be a treatise describing "the form of a just public weal," after the fashion of *Utopia*, but it is in reality a theory of education. Elyot complains, not without reason, of "cruel and *yrous* schoolmasters, by whom the wits of children be dulled," and of the practice of setting boys of fifteen to study the law. In his scheme of education he wisely insists on the importance of the arts of painting, music, and sculpture. The works of Ascham, especially his *Toxophilus*, or *Dialogue on Archery*, are better known to modern readers than most of the writings of this age, and have been frequently reprinted. Ascham was one of the most meritorious of the learned men of his time; no one knew more, or turned his knowledge to better account. His style, as Dr. Johnson says, "to the ears of that age was undoubtedly mellifluous." In 1553 appeared Wilson's *Art of Rhetorique*, the first work that laid down any definite rules for English composition, except a small pamphlet of the same name by Leonard Cox, a schoolmaster. Wilson writes with considerable ability and judgment. He blames the fashionable rejection of familiar and natural expressions for others more *recherchées*. "Him," he exclaims, "that can catch an ink-horn term by the tail, they count to be a fine Englishman and a good rhetorician." He also blames the conceit of alliteration, as compelling a forced and an inadequate style. The book is fraught with good sense, and was deemed important enough to procure the author an imprisonment when he visited Rome.* These

* "Wilson was a man of considerable learning, and his *Art of Rhetorique* is by no means without merit. He deserves praise for censuring the pedantry of learned phrases, or, as he calls them, 'strange *ink-horn* terms,' advising men 'to speak as is commonly received;' and he censures also what was not less pedantic, the introduction of a French or Italian idiom, which the travelled English affected in order to shew their politeness, as the scholars did the former to prove their erudition."—Hallam, *Lit. of Europe*, 6th edit., vol. 2, p. 309.

few pretty nearly exhaust the list of noticeable non-theological books before the accession of Elizabeth. Literature was still subordinate to the mighty influence to which above all things it owed its existence. The great distinction between the literature of reason and the literature of taste was vague, and not yet strictly recognised.

The influence of the Reformation upon the poetic art must be acknowledged to have been, for better or worse, almost incalculable. But we are not therefore to overlook other great independent causes of what is now beheld in English poetry; and still less are we to connect them with the Reformation, as subservient, in any attempt to make the latter a cause of causes. The question has been asked whether the great religious schism of the sixteenth century had any influence at all upon the formation and progress of an art. I believe that it has been most powerful both in bad and good results. The *hidden* influences of the Reformation—that promulgation of law and liberty—have been of infinite value in the history of English poetry; but, wherever it has visibly encroached so as to alter form and method it has been marked by narrowing and degrading consequences. We see this especially in the ante-Elizabethan period under notice. Literature, which is always more or less the reflex of society, is never so much so as in times of great political change, when one spirit agitates the mass of mankind, and seizes upon the most prominent and cultivated intellects as the organs of its inspirations. I have already remarked the disproportion between theological and other books during the former part of the sixteenth century, in proof of the extent to which the Reformation occupied the thoughts of men; and in an age when the domains of art were ill-defined, we must expect many strange effects from the irruption of a sectarian and bigoted spirit upon the land of ideal liberty and beauty.

The poets of the first part of the sixteenth century may

be nearly divided into those who followed classic models, and those who degraded their art into becoming the handmaid of religious partisanship.

Of the former class I may instance Surrey and Wyatt, in whom English poetry received from Italy a new form of graceful expression. Both these men were courtiers in the splendid household of Henry VIII; both were well versed in the literature of romance, and skilled in the knightly exercises in which that monarch took delight; both had travelled into Italy when the fame of Petrarch had created a tribe of sonneteers, and both reproduced all the cold *concetti* of the time. Their graceful madrigals became the delight of lords and ladies. Each Petrarch had his Laura; and love sighed in the most witty, frigid, sugar-coated verses. A great part of their works consists of translations from the Italian or French; each of them rendered or imitated much, especially of Petrarch; and Surrey gave a version of the second and fourth books of the *Æneid*, which is the first blank verse in our language. It is, as might be expected, somewhat inharmonious, and the sense is rarely carried beyond the line. He also lays claim, but with disputed title, to the establishment of metrical or syllabic versification, as distinguished from the rhythmical or accentual versification of Chaucer and his successors.* He and Wyatt are identified in history as the founders of what is called "the Amatory School of Poetry," which was continued in the *Paradise of Dainty Devices*, 1576, a collection of short pieces, contributed by Richard Edwards, Lord Faux, William Hunnis and others. It abounds in quaint-

* On Surrey's contributions to the improvement of our versification, on his introduction of blank verse, and on the claim made for him of having brought about a great revolution in our poetical numbers, see Hallam, *Lit. of Europe*, vol. i, pp. 430–35. See also Marsh, *Orig. and Hist. of Eng. Lang.*, pp. 515–17.

ness, in antithetical conceits, and in alliteration. It displays much of that exaggerated expression of the passion of love which is seen in the sonnets of Spenser and Shakespeare, but several of its love-songs are among the most beautiful in the language.

The most remarkable feature of poets of this class is the entire absence of anything like light and sportive gaiety, such as that of Herrick or Suckling. All is sad, plaintive, and mournful. "It seemed," Hallam says, "as if the confluence of the poetic melancholy of the Petrarchists, with the reflective seriousness of the Reformation, overpowered the lighter sentiments of the soul." * The same thing is true of Sackville's *Induction* to the *Mirrour of Magistrates*, published in 1559. It is said by Hallam to form a connecting link between the school of Chaucer and Lydgate and that of Spenser. It is a sort of allegory, vigorously sustained, full of imagination, and so far above the elegant coldness of Surrey that it may be compared, without disadvantage, to some of the best passages in the *Faery Queen*. Yet the unbrightened cloud which possesses most of the poetry of the age, the sadness of faith shaken by the spectacle of Church schism, and of imagination somewhat shackled by the contemplation of models deemed unapproachable, rests also upon it. Short as it is, its gloom and grief make it monotonous.

Of the poetry made a means of disseminating religious opinion, first appear the metrical translations of the Scriptures, and foremost among them, the well-meaning and well-known version of the Psalter by Sternhold and Hopkins. We find in the ranks of these metrists the names of Coverdale, Baldwyn, Hall, Pullain and Parker, with others also famous in history. Perhaps the most notable of them all,

* *Lit. of Europe*, vol. ii, p. 219. See also Taine, *Hist. Eng. Lit.*, v. i, p. 252.

in the difficulty of his undertaking, was William Hunnis, who actually turned into verse the whole of Genesis, and called it a *Hive full of Honey.* As "Sternhold and Hopkins" has been read and despised by most people, and is neither better nor worse than the rest, I need say no more upon the matter; but it is not wonderful that men of that age should have fallen even below themselves in an attempt which has quelled the strength of Milton.

From the Scripture versifiers we descend to the religious satirists, who abound chiefly in the reign of Edward VI. The most conspicuous of them are—Robert Crowley, a stationer, and Dr. Turner, a herbalist. The nature of their works may be judged of from their titles—by the one, *The Voice of the Last Trumpet blown by the Seventh Angel,* and *A Dialogue between Lent and Liberty;* by the other, *The Examination of the Mass,* a dialogue. Some epigrams by Crowley are preserved in Strype. They are wretched. A vast number of sectarian ballads was circulated by the partisans both of the Reformation and of Rome. One beginning, "Sing up, heart, and sing no more down," written on the coronation of Edward VI, created great excitement in London. Another, entitled *Luther, the Pope, a Cardinal and a Husbandman,* is characterised by Warton as "having some spirit, and supporting a degree of character in the speakers."

Such is, in outline, the history of poetry in England during the struggle of the Reformation. If there is a great name here, there is but one—that of Sackville.* The rest of the cultivators of the art may be divided into two great

* Hallam says that, "In the first days of Elizabeth's reign," Sackville "is the herald of that splendour in which it was to close. English poetry was not speedily animated by the example of Sackville. His genius stands absolutely alone in the age to which as a poet he belongs."—*Lit. of Europe,* vol. ii, p. 220.

bands—those who want spirit, and those who want refinement: the one party sedulously cultivating the adventitious graces of poetry, believing that the secret of pleasing lies now in frigid simplicity, now in hollow bombast; the other party possessing no poetical attributes at all, except vigour and verse. The first party breaks into the sepulchres of antiquity, to carry out from thence little but dust and ashes; while in the other, the spirit of poetry, which is creation viewed through the lens of the human soul—the beauty, the glory, the concord of the outer world, translated to the ideal world, imbued with the associations and inspired by the spirit of mankind—loses its highest office and is banished from its proper sphere, in order to become the medium of sectarian prejudice. I do not, of course, mean to be exact in such a statement, but in general it is true; although many minor poems of beauty and delicacy were produced in this age, yet they are not sufficient to stamp the character of its poetry, which is, as I have described it, now unduly timid, now rough and coarse. But that such a melancholy tuning of instruments should prelude "those melodious bursts that fill the times of great Elizabeth," was, as the case stood, unavoidable. That it did not last long is a subject of rejoicing.

We may see the same causes at work, and with the same results, in the case of the drama. But here I must be brief, as I have exhausted my time, and already trespassed too long on your patience. I can only say, in short, that the Reformation period urged the "Moralities," which were in high favour with the clergy, into a nearer approach to regular comedy by the substitution of individual satire and caricature for their allegorical and abstract personification. The advance was made in the reign of Edward VI, one of the earliest acts of whose Council was to prohibit the Roman Catholic clergy from preaching. Silenced in the

pulpit, they had recourse to the stage, whence they poured a flood of invective against the leaders of the Reformation. To repay in kind was no hard task for the latter, and many "Moralities" were written on both sides which display an odd mixture of heavy buffoonery and real comic farce. It is evident that, from the caricature of individuals, the gradation was natural to the representation of real life and manners, which is the business of comedy and tragedy. Besides their theological lampooning, a remarkable feature of the Moralities of this age was the introduction of certain fixed characters, as in the early Italian comedy and in our own pantomime. The most usual of these were the devil, and a witty, mischievous creation called "Vice." "This," says Mr. Hallam, "seems originally to have been an allegorical representation of what the name denotes; but the Vice gradually acquired a human individuality, in which he came very near to our well-known Punch. The devil was generally introduced in company with the Vice, and had to endure many blows from him."* These two were the darlings of the multitude. Full of pranks and swaggering fun, a part of Vice's ordinary business was to treat the devil with ribald familiarity, to crack saucy jokes upon him, to bestride him and beat him till he roared, and in the end to be carried off to the nether regions on his back.

The longest of the Moralities preserved, belonging to the time in question, and which were rightly termed "interludes," as oscillating between religious satire and comedy proper, is the *Enterlude* called '*Lusty Juventus*,' "lively describing the Frailtie of Youth, by Nature prone to Vyce, by Grace and Good-Councell traynable to Vertue." This piece is on the side of the Reformation. Another of these interludes, quaintly entitled *Jack Juggler*, is one of the oldest pieces in our language which professes to follow a

* *Ibid.* Vol. 1, p. 445–46.

classical original; the author stating in his preface that he was indebted to "Plautus' first comedy." It is far less involved in religious controversy than most of the Moralities, and might almost merit the name of comedy. The plot turns upon the blunders and confusions of a simple fellow, who, like father and son in *Vice Versa*, has been persuaded out of his own identity, believing "that he is not himself, but another man." Besides the liveliness of some parts of the dialogue, there is a decided attempt at character in the piece.

These examples are sufficient to shew how the Moralities were brought to the threshold of comedy. It was first crossed by Nicholas Udal, head-master of Eton school. Somewhere about the middle of the century, probably not later than 1540, Udal wrote the first English comedy, under the title of *Ralph Royster Doyster*, which, however, was not printed till 1566. The piece is by no means the barbarous farce which its title might lead us to expect; it is far superior to *Gammer Gurtin's Needle*, to which it is also prior in time. It is divided into acts and scenes, like those plays of Plautus and Terence of which it is a professed imitation. The plot progresses in five acts in rhyme more racy than elegant, and yet with a "singular freedom from the coarseness that in its time seasoned jesting even before the most select general audience."* Ralph is a vain, amorous hair-brain:

> "So fervent hot-wooing, and so far from wiving,
> I trow, never was any creature living."

His baffled pursuit of a gay and rich widow forms the action of the piece. A group of domestics, that might have formed

* See an analysis, with extracts from *Ralph Royster Doyster*, in Collier's *Hist. of Dram. Poetry*, vol. 2, 445–60. See also Professor Henry Morley's *Lib. of Engl. Lit.*, vol. 3, pp. 22–46, where the Play is given at length.

a study for Shakespeare in his happiest vein, opens up the domestic scenery of the metropolis warm with reality. The play, as Hallam notes, is of no slight value as presenting the earliest lively picture of London manners among the gallants and citizens. It contains a variety of character to which no other piece of a similar date can make any pretension; and Collier maintains that, when we recollect that it was written, perhaps, in the reign of Henry VIII, we ought to look upon it as a masterly production. Still, the best things in it are some songs and ballads, and the verses over a rejected lover. *

Gammer Gurtin's Needle (1575) is a meagre farce; but the author writing neither for fame nor money, but to make light-hearted boys laugh, and to laugh with them, must not be severely judged. It is something that a bishop could send forth a farce at all, for its author was John Still, Bishop of Bath and Wells. Fancy a farce from a modern bishop performed by Mr. Toole! Archdeacon Denison might crown the labours of his life with a capital one!

The tragic muse was not far behind. The first English heroic tale divided into acts and scenes, and clothed in the formalities of a regular tragedy, was *Gorboduc*, brought upon the stage in 1562. It was jointly composed by Sackville and Thomas Norton, a Puritan clergyman. It is the first English drama of any kind written in blank verse. The subject, like that of Shakespeare's *King Lear*, is taken from the fabulous British annals, originally compiled by Geoffrey of Monmouth, in the twelfth century, and innocently copied into the histories of most of the chroniclers down to the time

* See Bell's *Songs from the Dramatists*, pp. 15–19; or Professor Henry Morley's *Lib. of Engl. Lit.*, vol. 3, p. 26 ("The Work-Girl's Song"); p. 29 ("The Minion Wife"); p. 31 ("The Sewing Mens' Song"); pp. 33–34 ("The Psalmodie for a Rejected Lover"); p. 35 ("I mun be Married a Sunday").

of Milton. We see in it the desire to deepen and justify the pride of English nationality. The play is full of allusions to the existing state of things, enforcing the advantages of peace and settled government, the evils of popular risings and a disputed succession; but it is a stiff, academic piece, made by classic rule, with nothing either of English freedom or early extravagance to give it a place in the drama which foreshadows the age of Shakespeare. The succeeding tragedies, even before Shakespeare, departed widely from the frigid classicalism of *Gorboduc* by the admission of more action to the stage, and the addition of comic humour to the gravest story.

Here I must pause. We have seen the human intellect, in that great "shaking of the nations" which took place during the sixteenth century, enkindled at the torch of religious truth, arousing itself, and asserting its immortal power, so as, with exulting fierceness, to break through the encrustations of error and decay which had fallen upon the Church. We have seen much good perish along with the evil, and some unhealthy tendencies receive a dangerous development. We have seen philosophy severed from Christianity, and the dreary polemical war commenced which, for ages, was to exhaust the vigour of the Church, and postpone the time of a catholic spirit, and of a reconciliation between philosophy and religion. We have also seen the mighty tide that swept away good and evil, spread over the fields of literature and art, so that the imaginative faculties, denied their proper medium, were compelled to take refuge in the idealities of More, Lilly, and Elyot, those founders of the romance school of Rabelais and Cervantes. All this is disruption in social institutions, and anarchy in art. But we have not seen what was soon to follow—the blending and organisation of this tossing chaos. Imagination was soon to return to its former channel. Spenser was

to draw from the deeply-tinged mournfulness of Sackville and his fellows that noble gravity, and from the fancy of the Middle Ages that rich and solemn grotesque, which make him the great exponent of the highest spirit of romance. And Shakespeare was to be the "wreathen chain of pure gold" connecting the beauty and glory of the mediæval and modern world. Upon the clear surface of religious light, law, and liberty, art was to write her fairest characters.

THE HISTORY OF THE INTRODUCTION OF PERUVIAN BARK TREES (CHINCHONAS) AND THE PRESENT STATE OF CULTIVATION IN INDIA.*

BY JOHN BIRKBECK NEVINS, M.D. LOND.

Importance of the Bark as the Source of Quinine.—Extent of the South American Forests.—Reckless Destruction for above Two Hundred Years.—History of the Unsuccessful Attemps by Various European Nations for above a Century to Transplant the Trees to India.—Ultimate Success, and Present Condition of their Cultivation in India and other British and Dutch Dependencies.

Illustrated by Drawings, Photographs, and Leaves from several Species of Chinchona, now growing in Mr. Howard's Glasshouses, near London, and by a very fine Collection of Barks sent from London for the purpose by Messrs. Evans, Lescher, and Webb.

THE importance of Quinine (the active principle of Peruvian Bark) for the prevention and treatment of ague and remittent fever is so well-known as to need little mention. The Indian Government has expended as much as £25,000 in a single year in the purchase of Quinine, and the beneficial influence upon the health of the troops has well repaid the expense; for while in 1830 nearly four soldiers died in every hundred who were attacked by the fever, only one in a

*Principal authorities for the contents of this paper.
Travels in Peru and India, Markham.
Notes and Statistics of Chinchona Bark, Hamilton.
Christie's Prize Essay, quoted by Hamilton.
Countess of Chinchon and the Chinchona Genus, Markham.
Nueva Quinologia of Pavon, J. E. Howard.
Quinology of the East Indian Plantations, J. E. Howard.
Linnean Society's Journal—Botany. Vol. xx.
Correspondence with W. D. Howard, Esq.
Correspondence with Messrs. Evans, Lescher, and Webb, London.
Pharmaceutical Journal. Lindley's *Vegetable Kingdom.*
Various London Price Lists.

hundred died under the same circumstances in 1856, and in 1880 little more than one man in three hundred cases died.

Discovery of the Beneficial Effects of the Chinchona Bark.

The tradition of its virtues having been accidentally discovered by the South American Indians, and of its being known to them at the time of the Spanish Conquest, is of little value, for Humboldt, nearly two centuries afterwards, found that even in Loxa, its head quarters, the Indians regarded it as a poison; and Ulloa also asserted that the Peruvians were ignorant of its value. Humboldt did find an old tradition in Loxa that the Jesuits having noticed its bitterness, thought it might possibly be useful in ague, and found it to be so, and afterwards brought it into Europe.

Introduction into Europe.

The bark was first brought into Europe (Spain) in 1632, during the reign of our Charles I., but it was not employed medicinally until 1639, when the Countess of Chinchon, the wife of the Viceroy of Peru, who had been cured of ague by its use, brought some to Spain, from which circumstance it received the name of "Countesses' Powder." In honour of this illustrious lady, Linnæus gave the name of Chinchona to the genus; but, unfortunately, he derived his term from a French and not the original Spanish source, and omitting the "h" spelt it incorrectly as "Cinchona" in 1742, or "Cinhona" in 1767, and his mistake has been perpetuated in this country. Mr. Howard and other authorities on the subject have endeavoured to restore the true spelling of the name, and it is to be regretted that while correcting many other matters the British Pharmacopeia should have adhered to the mistake originally made by Linnæus, and retained his incorrect spelling of "Cinchona."

About ten years afterwards it was brought to Rome by the Jesuits, who used it with such success, that it gained the name of "Jesuits Powder." This name created such a prejudice against it in England that, even so late as Queen Anne's reign, it was regarded with great suspicion, and many persons refused to take it. One of the most noted personages who employed it in Rome was Cardinal de Lugo, and it became known as "the Cardinal's Powder," but after his time, it fell into disuse for many years. In the reign of Louis XIV, however, it again came into great note in consequence of the success with which Sir Robert Talbot employed it in Paris, from which it gained the name of "Talbot's Powder." The secret was purchased from him by Louis XIV, who made it public, and it was then known as the "English Powder."

After this date it does not appear to have had any name more descriptive than "Bark" *par excellence;* and "Huxham's tincture of bark"—a preparation recommended by an eminent physician in the time of George II and George III—was the name by which it was most familiarly known in England even sixty years since, and by which it is still kept in chemists' shops both in this country and America.

Discovery of Quinine.

For many years chemists in vain expended their ingenuity in endeavours to discover the active principle of Chinchona Bark, but at length, in 1820, two French chemists, named Pelletier and Caventou, discovered two alkaloids in it, to which they gave the name of Quinine and Cinchonine, names which they have retained to the present time.

General Description of the Chinchonas and their Native Forests.

The Chinchonas, or the trees which yield so-called "bark"

or Peruvian bark, grow upon the slopes of the Andes over an extent of about 1700 miles, or an area equal to the space between the White Sea and the Mediterranean; but they are never found further north than 10° or 11° north latitude in the forests of New Granada, or further south than 19° south latitude in those of Southern Peru and Bolivia. They are therefore strictly tropical plants; but they grow only at such an altitude upon the mountains that the heat resembles that of an English summer rather than the temperature of a torrid zone. It is curious, however, that even in their native home, and under circumstances which present no apparent differences, there are districts, here and there, extending over some degrees in the whole, in which either no Chinchonas grow at all, or such as are met with are destitute of any medicinal value, and are, therefore, entirely unworthy of cultivation. Unfortunate ignorance of this fact led the Dutch into great expense in the transmission and cultivation of worthless plants in Java, the culture of which has now been abandoned, after yielding no other profit than that of furnishing a lesson from which other cultivators have derived a valuable caution. Not only, however, are these trees thus limited within definite boundaries of latitude, but they are also dependent for their growth upon an elevation, which has to be very considerable in the case of many of the species. The tree which is capable of growing at the lowest level is the one which yields what is called "red" bark (*Chinchona succirubra*), and it flourishes between 2,500 feet, or an elevation nearly as high as the summit of Snowdon, and 5,000 feet, or an altitude equal to the top of Ben Nevis; whilst the trees which yield what are called the "grey" and "yellow" barks range between 7,000 feet, or the level of the Hospice of St. Bernard, and 9,000 feet, or the summit of Mount Sinai. Within these limits the greatest diversity exists in the soil and situation chosen by each species; for

whilst the "red" bark tree buries its roots deep in a rich soil many feet thick, the *C. Condaminea,* one of those which yield "grey bark," grows in the wildest and most inaccessible regions, in clefts of rock without an inch of soil; and the *C. micrantha*, which also furnishes "grey" bark, grows in low moist places, with its beautiful panicles of flowers drooping over the rivers into the very water.

In the character of the trees, as well as in their situation, there is also a wide diversity; for whilst the red and yellow bark trees, *C. succirubra* and *C. Calisaya*, attain the dimensions of large forest-trees, being from sixty to eighty feet high and twice the girth of a man's body, there are others which attain a height of forty to sixty feet, but with a diameter of not more than a foot, or even of a few inches only; whilst others again, varieties of the *C. Condaminea* and of the *C. Calisaya*, are mere shrubs, never exceeding a few feet in height.

With all these differences, however, there is one circumstance in which all are agreed, and this is, the necessity for about nine months of rain in the year, and the moisture arising from a tropical forest during the remaining three, which may be called the dry months. This indeed it is, which has proved the greatest difficulty to be overcome in extending the growth of these invaluable trees to other regions of the world. There are plenty of places with a tropical sun and an elevation of 7,000 or 8,000 feet above the level of the sea; but the difficulty has been very great of finding situations which, in addition to these requisites, shall also possess the necessary amount of moisture—an amount of which in this country we cannot form an adequate conception.

In speaking of the barks, as "red" bark, "yellow" bark, and "grey" bark, the terms are employed which have been in general use for centuries, and are correct in the

main, though it is often difficult and sometimes impossible to pronounce from the colour alone, to which class a particular specimen may belong. The large forest trees—*C. succirubra*—which grow exclusively in the district of Mount Chimborazo, have a bark which is of a generally red colour in the trunk and larger branches. The large trees also—*C. Calisaya*—which grow exclusively in Southern Peru and Bolivia, have a yellow bark in the trunk and larger branches; but in the smaller branches and twigs neither the red nor yellow colour can be defined. But in the more slender trees of the other species, many of which grow in the most exposed situations, the bark is often covered with lichens, which give the trees a general grey or whiteish aspect, and the bark itself has a light brownish nondescript colour, to which the general term "grey" has been applied. It is evident, therefore, that these terms are at best comparative and are often extremely indefinite.

The Chinchonas, growing over so great an extent of country and under such a variety of circumstances, it is not surprising that there should be many species, and Howard describes minutely 46 species or well-defined varieties, nearly all of which are illustrated by exquisite coloured drawings in his beautiful work on the Quinology of South America and the East Indies.* Markham, indeed, goes far beyond this number, and gives the names of 142 species or varieties in his Memoirs of the Countess of Chinchon.†

The health-restoring properties of the Chinchona have long been known, but it is only of late that we have learnt its beauty and fragrance in the forest. The leaves are large, and have a shining green surface, with crimson veins and

* *Nueva Quinologia of Pavon, and Quinology of the East Indian Plantations.* J. E. Howard.

† *A Memoir of the Lady Ann de Osorio, Countess of Chinchon, and Vice-Queen of Peru.* (London: Trubners & Co., 1874.)

leafstalks, which are so striking as to render the clumps of these trees visible at a very great distance, and it is by this means that the *cateador*, or bark collector, directs his course aright. He climbs the most lofty tree he can find, and soon discovers the groups of Chinchonas by the peculiar reflection of light from their surface, which is easily observable, even in these endless expanses of forest. Humboldt says of the *C. Condaminia*: "This beautiful tree, above sixty feet high, and six inches in diameter, seems always to aspire to rise above its neighbours in the dense forests, and as its upper branches wave to and fro in the wind, their red and shining foliage produces a strange and peculiar effect, recognisable from a great distance." The flowers are usually small, and grow like clusters of lilacs, being generally of a deep-roseate colour, dark crimson within the tube, the notchings of the flowers being bordered with white curly hairs, whilst the delicious fragrance scents the air in the neighbourhood. Mr. Markham is quite enthusiastic in his description of their charms: and when speaking of the poem composed in honour of these trees in 1726 by La Fontaine, at the request of the Duchess de Buillon, who had been cured of a dangerous fever by the bark, he remarks that La Fontaine could not expatiate also upon the exquisite beauty of the leaves and the delicious fragrance of the flowers, for they were not at that time known in Europe.

Reckless Destruction of the Chinchona Forests.

As the Chinchona forests cover a tract of country equal to the length of Europe from the White Sea to the Mediterranean, and possess such invaluable qualities to induce the preservation of the trees, it may appear strange that a necessity should ever have arisen for carrying the Chinchonas to new homes, separated from the Andes by half the circumference of the globe. But the recklessness of the

Spaniards has not been exhibited with greater wantonness in any other sphere of colonial action than in their treatment of the bark-forests. They have evidently thought, and acted upon the belief, that the supply could never come to an end; and during above two centuries and a half in which the bark has been collected, there is but one instance of cultivation known, and that to a very limited extent by the Jesuits, to replace the trees which have been destroyed at the rate of 25,000 a year in one limited district alone. The consequence of this has been that it is now necessary to travel many days' journey into the forests before a single tree can be found, even in the heart of what used formerly to be the head-quarters of the collecting districts. Not only are the bark-gatherers too careless to replace by new ones the trees they destroy, but they are sometimes too indifferent even to turn a tree over to separate the bark from the side upon which it has fallen. In consequence of this, whole districts from which large quantities used formerly to be obtained, now furnish scarcely any bark, and the most serious apprehensions have long been felt by those who have been aware of the facts and have taken an interest in the matter.

Unsuccessful Attempts for above a Hundred Years to Transplant and Cultivate Chinchonas in Various Parts of the World.

Many attempts have accordingly been made to collect and transplant this valuable tree, but the fates appeared to have conspired against them; for at one time fire, and at another water; now a casual river-wave, and now an Atlantic storm; now drought, and now excess of moisture; and lastly, robbery and murder, have all played their part in rendering the efforts fruitless to accomplish this great purpose.

In 1739, Jussieu, a most eminent French botanist, travelled on foot through a great part of the Andes, and

after fifteen years' laborious work made a large collection of plants, which he conveyed to Buenos Ayres. But here his servant stole the boxes containing them, under the belief that they contained money. Poor Jussieu took the loss deeply to heart, and returned to France, deprived of reason, after thirty-four years of wandering. His name, however, is still associated with the sphere of his labours; for Weddell has named one of the species *C. Josephiana* in honour of this eminent and unfortunate naturalist.

In 1743, La Condamine, an eminent French botanist, obtained some young plants from Loxa to be taken down the Amazons to Cayenne; but a wave washed over his little vessel near the mouth of the tributary river Para, and carried off the box in which he had preserved his plants for more than eight months. "Thus," he says, "I lost them, after all the care I had taken during a voyage of nearly 4,000 miles."

In 1778, Ruiz and Pavon were sent out by the Spanish Government, and made a large collection of plants, and sent them off in fifty-three boxes, which were all lost by shipwreck in a storm when off the coast of Portugal, and, as it were, in the very haven of their desires. They returned therefore in 1785 and obtained another large collection; when a fire broke out in the house, and destroyed the whole result of their labours.

In 1770 Caldas, a native of new Granada, explored this bark district, and obtained much valuable information; but his end was untimely, for he was shot in 1806 by the brutal Moretto, who massacred above 600 of the most distinguished men of the country, in the wars of independence of the Spanish colonies.

At length, in 1848, fortune seemed to smile upon the perseverance shown in this cause; and Weddell brought some seeds in safety to Paris, where they were raised in the

Jardin des Plantes, and some of the plants were sent to the Horticultural Society of London, where one of them flowered; many others were given away, and some were sent by the Dutch Government to Java.

In 1852, at Dr. Royle's request, H.M. Consuls were desired to obtain seeds and plants in America, and Mr. Cope, the Consul-General of Ecuador, sent home some plants, but misfortune was not yet weary, for they all died on their arrival in England in 1855; and although at the same time some plants raised in the Edinburgh and Kew Gardens were taken in safety to Calcutta by Mr. Fortune, they all died during their removal to Darjeeling; and the seeds which were sent at the same time, never germinated.

In 1853, the Dutch Government sent out a distinguished botanist, M. Hasskarl, from Holland, to collect plants and seeds in Peru, and he succeeded in collecting some ripe seeds in the forests of Tarma; but it has since been found that the trees in that region are worthless, as the bark contains neither quinine nor any other medicinal alkaloid. He did indeed obtain 400 good plants from a native agent, which he sent across the Pacific to Java; but of the whole 400 plants two only survived the voyage.

In 1859, Mr. Markham was sent out by our own Government, and he succeeded in sending home 456 plants of the most valuable species of Chinchona, which reached England in health. A few were left in the Kew Gardens for safety, and the rest were sent overland to India in Wardian cases, were they arrived in October, 1860. But the heat in the Red Sea had been intense, and there was a detention of a week in Bombay, which produced a fatal rot in their roots; and although the leaves looked green and healthy on reaching India, nearly the whole died soon after their arrival. Several hundred cuttings were however taken from the plants which still seemed fresh, but they all failed to strike.

With one more catastrophe we close our chapter of accidents. Half a mule-load of valuable young plants from another district of America (Huanuco) left Lima for England about the same time, and arrived here in perfect safety; but they were all dead on their arrival in India.

Thus it seemed as if an insuperable fatality opposed all attempts to transport this tender and valuable tree into India, where its presence would not only be a boon to the Government as regards the health of the army, but would prove also an incalculable benefit to the poorer native inhabitants, who suffer from fever as well as ourselves, and are quite unable to purchase quinine, from its costly nature. But though disappointment had hitherto attended all efforts to accomplish the object, despair was not the result. Many valuable lessons had been learnt from previous failures; and when the Secretary of State for India selected Mr. Clements Markham, in 1859, he chose a man who was already acquainted by personal experience with the Chinchona forests, who had learnt the lessons from the failures of others, and was so happy as to obtain fellow-labourers in Mr. Spruce, Mr. Weir, Mr. Pritchett, and Mr. Cross, who devoted themselves heart and soul to the work; and it will now be our more agreeable task to narrate the steps by which success was eventually achieved.

Mr. Markham's Proceedings in Collecting *C. Calisaya*.

In collecting and conveying the Chinchona plants, many dangers had to be encountered, and difficulties overcome. The trees grow in the depths of the forests, through which no tracks exist, and on the edges of ravines where a single false step is liable to prove fatal to the bearer or his load. The plants themselves, accustomed only to a warm damp situation, had to be transported over ranges of the Andes covered with snow to the port of shipment; and when there,

and on their voyage, they were at a level many thousand feet below their natural habitat, and had to endure a tropical temperature instead of that only of an English summer. And, independently of the mere difficulty of finding plants fit for removal, the American Governments and their agents threw every obstacle in the way of their removal; and fine and imprisonment are the penalties awarded to any one, native or foreigner, who shall export any of these precious inhabitants of the soil. But these points will all be more fully illustrated in following Mr. Markham and his coadjutors through their arduous and successful undertaking.

In anticipation of these difficulties, Mr. Markham arranged to go to the "yellow" bark district of Caravaya himself, taking Mr. Weir as his assistant. He despatched Mr. Spruce, an accomplished botanist with great experience of the wilds of South America, to the "red" bark regions of Chimborazo, having Mr. Cross for his assistant, with instructions to obtain seeds from the valuable "grey" bark trees from Loxa; and Mr. Pritchett was sent to the Peruvian district of Huanuco, which also yields valuable "grey" barks. By these arrangements he hoped to obtain all the species of Chinchona which possess medicinal value, except those from New Granada, and these he was fortunate enough to receive from Java in exchange for other species. By employing so many agents and in such varied places, the chances of success were increased; for with one collector alone "in such wild unfrequented regions, all is uncertainty; for along the the dizzy path of the Andes a single false step may dash the fairest hopes, and disappoint the most careful calculations.".

In December, 1859, Mr. Markham sailed from England and crossed the Isthmus of Panama *en route* for Lima, whilst he sent thirty very large Wardian cases * round Cape

* Each case was 10 feet 10 inches long, 3 feet 3 inches broad, and 3 feet 2 inches high, and weighed with the soil and plants rather more than three hundredweight.

Horn, to be in readiness for the various collections, as soon as they should be brought to the coast.

After travelling through varied and magnificent scenery in the gradual ascent of the Andes, Mr. Markham arrived about the end of March at Apo (14,350 feet elevation), tired, drenched, and cold; the roof of the post-house so badly tiled, and the doors so roughly fitted that it was impossible to close them. Both man and beast are here subject to a most distressing illness, called *sorochi* by the Peruvians, caused by the rarefaction of the air at these great altitudes; and as he was suffering from a sharp attack of illness before his arrival here, he was affected with the violent pressure on the head and neck with more than the usual severity, so that when he recommenced his journey at 3 a.m. the next morning, he was unable to mount his mule without assistance. In this condition he had to travel through a storm of hail and snow, until after several weary hours, which extended into the darkness of night, they arrived at the highest part of the road, 15,000 feet above the level of the sea.

From this point he descended to Puno, whence he proceeded to the Chinchona forests of Caravaya. At Sandia he procured four Indians and two mules, and laid in a stock of provisions to last for a month; for beyond this point there was no chance of obtaining supplies, and the danger arising from failure of provisions in these forests is not slight. Dr. Weddell, whilst ascending the mountains, fell in with the hut of a bark-collector, the owner of which was stretched in the agonies of death, nearly naked, and covered with myriads of insects, whose stings had hastened his end. His face was so swollen as to be unrecognisable, and his limbs were in a frightful state. Such is the end to which their hazardous occupation exposes the bark-collectors,—death in the midst of the forests, without help and without consolation. But the uninhabited parts of the forests are not

always the most dangerous. A young Englishman, named George Backhouse, went into the forest to collect bark in 1851, accompanied by Colonel Bologenesi and a party of Indians. They fell in with some of the Chunchos, natives of the forests, who engaged at first to assist them in return for knives and other presents; but shortly after refused to work, when a quarrel ensued, which ended in the massacre of poor young Backhouse and nearly all his party.

A melancholy fate like this did not however befall Mr. Markham; but his expedition was now in great danger of failing in consequence of his meeting with a certain Colonel Don Manuel Martel, who, being a staunch conservative and protectionist, and surmising the object of his journey, was determined to prevent his country from being ruined by the cultivation elsewhere of its native produce. He accordingly spread abroad the report of Mr. Markham's nefarious intentions, and the latter was therefore obliged to make his arrangements with the utmost despatch, and enter the forest with less preparation than he would otherwise have wished.

After a time, they had penetrated so far that the road was unknown to his Indian guides, and entirely grown up, as it had never been travelled since the bark trade of that part of the country had come to an end, fifteen years previously. They had therefore to force and cut their way for many hours with great difficulty through forest and jungle so dense, that it was often nearly dark at midday, until at length they came upon the bank of a river which afforded easier passage. Through similar difficulties they continued their journey till they came to a little hut, the last inhabited place known in this region, and here they had but six days' provisions left; the owner of the hut being little better off than themselves, and living upon roots and frozen potatoes. Beyond this point there has never been a road at all, and they had to cut their way as best they might, with the

Tambopata boiling and surging at intervals over the rocks below them, rendering it necessary for them to cross the chasm here and there on the fallen stems of tree-ferns rotting from age.

They were now in the heart of the Chinchona district, and as the trees were most abundant on the side of the river opposite that on which they had encamped, Mr. Markham was extremely anxious to cross it. It came on to rain however so heavily in the night, and the water rose so much, as to occasion fear lest they should have been overwhelmed in their tents. The next day, by stripping, and using a long pole to steady himself, Mr. Markham tried to ford the river, but was obliged to give up the attempt, after being as nearly as possible twice carried away by the force of the stream. Here, however, they found a number of young saplings, which they uprooted, and carefully packed in moss, their operations being retarded by the maddening pain from venomous insects, and especially from a species of fly, which in a moment raised swellings and blood-red lumps all over the hands and face. In continuing their search, the whole way was along giddy precipices seeming to hang halfway between the sky and the roaring torrent, with no foothold but decaying leaves, and nothing to grasp but rotten branches. After a hard days' work, they had only collected fourteen plants fit for removal; and when they returned to their tent, dead-beat with fatigue, it was only to find the Indians in a state of mutiny, and determined upon returning home, as they had neither maize nor coca left.

As it would have been impossible to carry the plants back if the Indians had deserted him, Mr. Markham despatched the most trusty of his party to the hut they had left a few days previously for fresh supplies if possible; and, after his departure informed them in the best native dialect he could command, that they were thieves, liars, traitors, and children

of a certain old gentleman, who would undoubtedly soon punish them if they went back, whilst he (Mr. Markham) would reward them well if they remained faithful. This forcible expression of his opinion produced a good effect; and a friendly evening closed the mutinous and alarming day.

Next day disappointment still prevailed, for only worthless Chinchonas could be found, the good ones having long been exterminated; and again he returned to his tent, stung with hornets, his hands sliced in pieces by the sharp-cutting edges of the leaves of a plant called Challi challi, and with only three plants of valuable Chinchonas.

Mr. Markham now again made the attempt to cross the river, which had been gradually subsiding for some days; and supporting himself by the stem of a young palm, he waded up as far as the middle of the stream; but here the stones slipped from under his feet, the water, which rushed down with great velocity, came nearly to his arms, and it was with the utmost difficulty that he retained his hold. At length, however, he gained a firm footing, and eventually crossed the river, and was rewarded by finding a good supply of healthy *C. Calisaya* plants, of which he secured above a hundred. After some further stay he obtained above four hundred fine, healthy young plants, which were carefully placed in layers by Mr. Weir, with plenty of moss between them, ready to be sewn up in matting, and transported across the snowy summit of the Cordilleras for shipment at the coast.

But now fresh difficulties commenced; for his host informed him that he had received an order from the Alcalde of Quito, ordering him to arrest Mr. Markham and his party, and prevent a single plant from being removed. As however he was alone there was a difficulty in the way of his arresting a party of six men; and Mr. Markham kept constant watch over his precious plants, and so prevented their destruction;

at the same time telling his host that his (his host's) views of the matter were entirely incorrect, and he (Mr. Markham) should defend his own property until he had taken it safely away. This he did in the morning; but after travelling some hours they met the sturdy protectionist Martel, evidently waiting for them; but as they presented him with a view of a revolver—albeit the powder was damp, though he was not aware of this fact—he became very civil, and allowed them to pass without molestation. It was soon evident, however, that the country had been raised in opposition, and that Martel had only withdrawn his forces to plant them in a more favourable position for conflict. So Mr. Markham divided his company, and sent Mr. Weir and Pablo on the highway, where Martel was likely to meet them, with the mules and the baggage of no value, but without the precious Chinchonas; whilst he himself, by a timely bribe, procured other mules to carry the plants, and went over waste and untrodden parts of the mountains, so as to avoid all places of resort, and towns or villages on the way. Here he nearly lost a large portion of his treasures, for, in skirting along the edge of a precipice, the cargo-mule fell headlong down it, and was intercepted far below by the trees and brushwood. They could see its legs kicking in the air, but it was some hours before a circuitous path could be cut, so as to extricate her, and bring her up again in safety.

But though free from pursuit along these trackless parts, the difficulties were increased. On pitching for the night, with the cold intense, Mr. Markham found that his bag of food and lucifer-matches had been stolen at Sandia, the last place at which he had stopped; and after being ten hours in the saddle, and faint from hunger, they had to go supperless to bed, with the cold penetrating to the very marrow. It is impossible to restrain one's feeling of admiration, after this description, on reading casually a page or two further on:—

"Every night I had wrapped the Russian mats which inveloped the plants in warm ponchos, and the tent." Such loving and faithful care of his valuable charge deserved the success which he achieved; for he had the satisfaction of avoiding all hindrances on the way, and bringing the young plants in safety to the port of Islay, where they were deposited in the Wardian cases, and soon showed that they had recovered from the risks of their exposure in crossing the frozen Cordilleras, by putting out buds and young leaves.

But further trials of his patience were still in store for him; the superintendent of the Custom House said it was illegal to export chinchona plants, and refused to let them go, until, with great difficulty, Mr. Markham obtained an order from the Minister of Finance at Lima permitting it. One further risk, and they were safely at sea. On the night previous to sailing an attempt was made to bribe the man in charge of the cases to bore holes in them, and kill the young plants by pouring boiling water upon them, but happily without success; and the next day they set sail for Panama, to cross the Isthmus there, and thence to be conveyed by sea to England, where they arrived in health in August, 1860. They were immediately sent by the overland route to India, and the result has been already mentioned. After escaping from political perils and the dangers of the road, after surviving the icy region of the summits of the Andes, the heat of the Pacific, and the changes of conveyance connected with the Isthmus of Panama, they fell victims to the heat of the Red Sea, and the detention at Bombay; and the plants, whose varied fortunes we have thus followed, were fatally affected with rot on their arrival in India, and died on reaching the Nielgherry Hills, the place of their ultimate destination.

Mr. Spruce and Mr. Cross's Proceedings in Collecting "Red" and "Grey" Barks, and their Introduction into India.

Whilst Mr. Markham was engaged in collecting the "yellow" bark, *C. Calisaya,* in Caravaya, Mr. Spruce was occupied in obtaining the "red" bark, *C. succirubra,* in the mountain slopes of Chimborazo, where he experienced difficulties and dangers in most respects similar to those just described, but with one important difference. In Peru and Bolivia the forests have no established owners, but in Ecuador they are all the private property of individuals, and from them Mr. Spruce, after considerable negociations, purchased permission to collect as many plants as he liked, on condition that he did not touch the bark of any standing trees.

A severe rheumatic and nervous attack, almost amounting to paralysis, obliged him to depute the duty assigned to him to Dr. Taylor; but at the last moment he determined upon undertaking it himself, and carried it through successfully, though he was suffering severely from illness all the time, and his headquarters, during the whole period of his work in the forests, was the upper-story of a sugar-cane mill, to which he climbed each night, by means of notches cut in the sides of the trunk of a tree. The floor and walls were made of rough plants, which nowhere touched each other, so that the place was full of fog, causing aching limbs and mouldy clothes. "Though upheld," as he says, "by a determination to execute, to the best of my ability, the task I had undertaken, I was but too often in that state of prostration, when to lie down quietly and die would have seemed a relief." A few examples will illustrate what that task involved to a man in this condition. On reaching the Pumachaca river, he found that the ford had been destroyed by the falling of a cliff, and that in its place a deep whirlpool had been formed. He therefore collected the driftwood on

the banks, and made a bridge over the narrowest part of the river, which supported himself and his party in crossing, whilst the horses swam across with great difficulty; after which it was necessary to roll down stones and earth so as to make an incline on the brink of the river, up which they could ascend to the summit of the bank.

On a subsequent journey to Loxa, for the purpose of securing the Crown bark, Mr. Cross had to pass through dense swampy forests, over precipitous ridges of the Andes, and in crossing one of these his mule slipped down a deep ravine, and was dashed to pieces. Indeed, the situation of many of the trees is so difficult of access, that Mr. Cross had frequently to descend into the ravines, where he saw them growing, by means of the trailing stems of forest species of Passion Flowers.

The excessive moisture of the bark region could scarcely be more convincingly shown than by the fact that the seed-vessels of some of the flowers were covered with lichens even before the petals of others had fallen off.

Mr. Spruce was so fortunate as to find the seeds ripening rapidly, and an Indian being sent up the trees, broke off the panicles very carefully, and threw them down to the ground upon sheets spread underneath to catch any loose seeds. They were then spread out in the sun, where those which were not quite mature when gathered quickly ripened, and by this means he obtained above 100,000 ripe seeds of the most valuable species of chinchona. In the intervals of seed-gathering Mr. Spruce was employed in making cuttings and layers for the most healthy young trees; and, with the valuable assistance of Mr. Cross, who had the principal charge of this department, above six hundred of them rooted, and were safely established in Wardian cases, and arrived in this country in perfect health.

The collection of chinchona plants by the Dutch in a

previous year, and now by Mr. Markham and Mr. Spruce, excited the feelings of the natives, and caused the various legislatures to enact laws by which a heavy fine, and other penalties, were imposed on all who were engaged in removing plants or seeds; but fortunately before the 1st of May, 1861, when these acts were passed, both seeds and plants were growing in undisturbed safety on the Nielgherry Hills in India, to which we shall now accompany them.

Difficulty of finding a suitable situation in India for the Cultivation of the Chinchonas.

The great difficulty in connection with Indian cultivation was to find a situation in which nine months' rain, or thereabouts, could be obtained, along with an altitude of several thousand feet within the tropics. There were plenty of places where the latitude and the elevation of the mountains were suitable enough, but they have rain for a few months only, and perfect drought during the rest of the year, whilst the chinchonas require moisture as well as a moderate heat even during the dry season. At length Mr. Markham fixed upon the Nielgherry Hills, just above the Government station of Ootacamund, as a situation which combined all these requisites. They are between 11° and 12° degrees of latitude distant from the Equator, and rise to a height of above 8,000 * feet above the level of the sea; whilst their peculiar isolated situation near the tapering extremity of Hindostan causes them to receive both the south-west monsoon from May to September, five months, and also the north-east monsoon from October to March, five months, so that they enjoy nearly nine months of rain in the year.

In this situation, therefore, the first plantations of chinchona were fixed; and warned by previous sad experience,

* Dodabetta, the highest peak, is 8,600 feet above the level of the sea, and Ootacamund is 7,300 feet above the sea level.

the plants this time were sent out in spring, during a cold season of the year in the Red Sea, instead of in summer as on the former occasion, when the heat proved fatal to them all. Some of the plants obtained by Mr. Markham and his coadjutors, and many of the seeds, had been retained for propagation in the Kew gardens, where they had sprouted and flourished favourably, and these plants, along with one of special interest, given by Mr. Howard, were the stock which eventually reached India in a healthy condition. Both plants and seeds this time arrived in perfect safety; and, under the able management of Mr. M'Ivor, the superintendent of the Government gardens at Ootacamund, thousands of young plants have been propagated from the seeds and from cuttings, and in 1862 nearly 100,000 healthy plants were rooted, of which a considerable proportion were planted out permanently, and another large proportion was in the hardening-off frames in the open air.

History and Present Condition of the Cultivation of Chinchona in India and elsewhere.

India.—The Chinchonas having at length been safely introduced into India, we may now trace the progress of cultivation there and elsewhere.

The cultivation commenced in 1861, in the Government Nielgherry gardens, Ootacamund, with 635 plants. These had increased to 277,000 in three years, under the skilful treatment of Mr. McIvor; or, each plant had multiplied above four-hundredfold. But his success was still more marked in the case of a single plant of *C. Uritusinga* (one of the grey barks), sent out by Mr. J. E. Howard from his glass-house at Tottenham, as a present to the East India Government. This tree was five feet high, and by taking small slips and "eyes" from it, Mr. McIvor raised no fewer than 6,350 healthy young plants in less than nineteen

months; and it is from this single tree that India has practically been stocked!

In 1882, these Nielgherry gardens contained about three million plants, which yielded 242,000 lbs. of bark, at a profit varying from time to time, but averaging nearly £30 an acre in a favourable year.

The Government plantations are chiefly at—

Darjeeling,	occupying	2,344	acres.
Madras	„	888	„
Burmah	„	only 50	„

Ceylon.—It was many years before the cultivation of Chinchona took any practical hold upon the planters in Ceylon, although the lofty mountain near the centre of the Island—Adam's Peak—possessed all the monsoon and other advantages of the Nielgherry Hills, and the soil was also favourable. In 1861, there were but a few plants in the Government gardens at Hakgalla, but in 1877 there were five-and-a-half million plants, in 1880 fifty million, and in 1882 probably sixty-five million plants.

Area under Cultivation.—In 1870, there were but 200 acres devoted to Chinchona cultivation, although it was becoming known that these trees might be profitably cultivated along with coffee in the coffee plantations. After this period, however, the cultivation extended rapidly, and in 1880 there were 33,568 acres, and in 1882 43,500 acres under cultivation.

Yield of Bark.—The yield of bark in 1878 was three million pounds, in 1883 seven million, and it is thought probable that in 1887 the yield will not be less than ten million pounds.

The *species chiefly cultivated* are—

*C. Ledgeriana.**—Most eminently successful; but it

* For an account of this remarkable species, see p. 321.

requires a special climate, and does not succeed in every situation. It does not grow at lofty elevations like the more hardy Chinchonas.

C. Calisaya—to which the same remarks apply.

C. Succirubra.
*C. Robusta.** } Have been thought to be the most reliable, but Mr. Howard has proved that the *C. Succirubra* deteriorates beyond a certain age. The Chinchona-tannic acid, which is present in the bark, rapidly oxidises and forms Cinchonine and Cinchonidine instead of Quinine, and he discourages the extensive cultivation of this species. He says, "The true *Calisaya* (*Ledgeriana*) will assert its superiority as the prince, or rather queen, of all Chinchonas for the production of Quinine."

C. Officinalis—which is by far the most delicate, and often dies vexatiously in the second third or fourth year of its growth.

A circumstance connected with the shape and structure of the conical mountain upon which all the Chinchona plantations have been placed, affects their continuous and profitable character in a curious manner. The soil consists to a large extent of the decaying vegetation which is so rapidly formed in tropical climates, but the torrents which flow down the sides of this conical mountain wash away this loose soil, unless it is retained by artificial wall-work, which is expensive, or it is entangled and retained in its place by the roots of the rapidly growing and rapidly decaying tropical vegetation. As a consequence of this, when the soil is

* A Hybrid, between *C. succirubra* and *C. Officinalis.*

brought under culture, and trees are planted in it at the distances required by artificial cultivation, this superficial virgin soil becomes exhausted or washed away, and the plantations, whether of coffee or chinchona, cease to yield profitable results, and in many cases are abandoned to nature. Being thus freed from interference, the wild tropical vegetation rapidly resumes the forsaken ground, and in a few years the mountain side is again covered with a rich, loose, decaying vegetable soil, which is again favourable for a renewal of the cultivation which had had to be discontinued.

Java.—The first cultivation by the Dutch in this Island was in 1854, and they deserve well of the world for having been the pioneers in the transplantation and cultivation of these invaluable trees, though their first attempts were not crowned with success. In that year, Mr. Hasskarl collected a number of Chinchonas in Peru, but they proved, unfortunately, to be a species (*C. Pahudiana*) which yields no valuable alkaloids, although this was not known at the time. After about twenty-five years' perseverance, the Dutch Government has at length relinquished the attempt to continue the cultivation of this species.

The first plant cultivated from seed in Java was brought from Paris. It had first sprouted there, and was taken thence to Leyden, and afterwards forwarded to Java, where it arrived in 1852; but like those first sent from England to India (p. 304), it suffered so much on the voyage that it died soon after its arrival, though one single cutting had been obtained from it before its death.

At length, in 1879, Mr. Ledger succeeded in obtaining some seeds in South America, which he believed to be of exceptional value; and the Dutch Government purchased a quantity from him, and its enterprise has been well rewarded.

This extraordinary seed was obtained from *C. Calisaya* trees of exceptional age and splendour, and the variety has received the name of *C. Ledgeriana* in honour of its discoverer, for while the previously known barks only yielded from two to four or five per cent. of valuable alkaloids, this remarkable bark has yielded as much as thirteen (13·35) per cent. of Quinine.*

Although the price of this seed ranges from £9 to £21 per *ounce*, according to its quality, the seeds have proved so richly to deserve it that there are now fifty estates cultivating them in Java; and they are also now cultivated in India as well. It is expected that by the year 1888 there will be 8,000 acres devoted to the cultivation of this species in Java, and, judging from past experience, this will yield a million pounds of the finest bark per annum.

Jamaica.—The cultivation in this island is at present small, but it is increasing, though it can never become extensive, as it is estimated (Hamilton, p. 46) that under the most favourable circumstances there cannot be more than 5,000 acres of plantation, as the area suitable for Chinchona is very limited in Jamaica. At present about 580 acres are planted.

Mexico.—The late Emperor Maximillian took great interest in the attempt to cultivate Chinchona in Mexico, and about fifty acres are under cultivation, the plants being grown from seeds sent from India in 1866, and again in 1871. But his sad fate has put a stop to its further extension for the present (Hamilton, p. 47).

Bolivia.—In 1878, earnest endeavours were made by some private individuals to cultivate Chinchona in Bolivia;

* Hamilton's *Notes and Statistics of Chinchona Bark*, p. 45.

but the difficulty of obtaining suitable land from the government, the absence of good roads and the consequent cost of conveyance, and also the danger to the plants under two years old arising from droughts and the attacks of ants have hitherto prevented anything approaching to success in this praiseworthy attempt (Hamilton, 48).

METHODS OF PROPAGATING CHINCHONA.

The various methods of propagating plants by means of layers, slips, and seeds have all been successfully adopted in the case of Chinchonas, and their respective advantages appear to be as follows :—

Layering.—"It will probably prove that the pure strains can only be kept so by propagating from layers."—Letter from W. D. Howard, Esq., January 3rd, 1884.

Slips.—Mr. McIvor, in India, in the Neilgherry Gardens, found that *very small* cuttings (even a single leaf with its axillary bud attached) struck new roots, and the smaller the slip apparently the more certain it was to root. In this way he multiplied Mr. Howard's *C. Uritusinga* six thousand three hundred and fifty-fold in nineteen months, and increased the 635 original Chinchonas sent from Kew to 277,000, or above four hundred-fold, in three years.

Seeds.—The most valuable results hitherto have been obtained by means of seed recently obtained in South America by Mr. Ledger, and the seeds obtained from his plants are those most in demand by Chinchona cultivators. But while the seeds from the native uncultivated Chinchonas in the American forests appear to retain their individual specific character, there seems to be a great liability to "hybridization" among those from cultivated Chinchonas. The late Mr. J. E. Howard does not appear to attach so much weight to this risk as some other authorities, but the present feeling upon the question appears to be expressed in a letter

from Mr. W. D. Howard (January 3rd, 1884):—"The question of the day for Chinchona growers is the easy hybridization of plants of different sorts grown near each other," which introduces considerable uncertainty as to the value of the plant that may spring even from seed supposed to be of a good stock.

Methods of Cultivation.

Various methods of cultivation have been adopted after the seeds have sprouted and the young plants have taken root, and the result of experience now seems to be pretty well established.

Chinchona plants suffer more from *excessive* moisture than from drought; and when cultivated they require less rain than when wild.

In Java, in the early stage of their cultivation and previous to extended experience, the plants were grown under the shade of other trees, in order to imitate as nearly as possible their natural habitat in the dense American forests; and *large* slips were employed for propagating them. This plan, however, has not proved successful, and is now practically abolished.

Mr. Markham observed that the healthiest and most vigorous trees in Peru grew in open spaces, exposed to wind and sun. And Humboldt had remarked that the trees seemed to crave for light and air, and often ran up slender and branchless until they could overtop the neighbouring trees. It has also been observed that the higher the altitude on the mountains the richer in alkaloids was the bark.

Mr. McIvor, in India, therefore, determined to expose the young plants to free air and light in a good light soil as soon as they had fairly struck root and put out leaves, shading them, however, from the glaring sun; and the result has proved the value of this method.

Mr. Howard, who has been a successful cultivator of many species of Chinchonas in his glass-houses at Tottenham, says, "Cultivate them as shrubs, and let them have room to expand laterally."

Dr. Weddell has proposed as a good plan that they should be planted along with quicker growing trees for the first two years. These trees should then be cut down lest they should absorb too much of the nutrition of the soil.

In Cultivating them from Seed the directions contained in Christy's "Prize Essay" (quoted by Hamilton, p. 38) are that *good ripe seed* from well-grown trees, not from shaved ones (see p. 316), should be put into *finely-sifted mould under cover*. Constant attention is necessary to ensure success, but Mr. Christy does not specify what kind of attention.

In *four months* prick out the seedlings into roughly-covered nurseries, and in a few months more transplant them into the clearing.

The best soil and situation for Chinchonas are, he says, a deep friable rather gritty or quartzy soil, on a fairly steep hill-side, with an *eastern* aspect. The depth of the soil is more important than its richness, and a good soil for coffee-trees is a good Chinchona soil.

On newly-cleared soil they grow more quickly, but they also die more quickly than in an old coffee plantation; so that on the whole the coffee plantation is as good as a new clearing for producing *quantity* of bark, but a new rich clearing gives better results as regards *quality* (Hamilton, p. 38).

Different Methods of Harvesting Bark and their Results.

Coppicing.—In the early stage of Chinchona cultivation, the branches when about two years old were cut off and stripped of the bark, their place being soon taken by new

shoots, so that a harvest of bark was thus obtained every other year. In some plantations the young shoots and tops are still treated in this way, but experience has proved that young bark yields a smaller proportion of alkaloids than that from old trees or branches. This method has, therefore, gone a good deal out of use, though some planters think it will still be the best plan in situations which will grow young trees, but will not support trees of great size. Large trees also require a longer period of time before they yield a profitable return.

Stripping and Shaving.—These two methods are at present contending for the preference.

Stripping.—This method, which was proposed and practised by Mr. McIvor, consists in making vertical incisions quite through the bark down to the cambium, and removing the bark so as to leave alternate vertical strips of bark and bare wood. The bark obtained in this way is said to be preferred by Quinine manufacturers and by the brokers; and a period of from six to twenty months renews the bark, and the *new bark is richer in alkaloids* than the old. The yield is often almost doubled.

Shaving.—A method introduced by Herr Moens. It consists in peeling off layers of bark from the entire circumference of the trunk, taking care not to go quite down to the cambium, but as near to it as possible. In this case also a new formation of bark takes place in from four or five to twenty months, and this *new bark also is richer in alkaloids* than the old. But Mr. W. D. Howard says, "the value of the *renewed* shavings varies very greatly, in some cases disappointingly so." And Captain Cox, the Government Inspector of the Chinchona plantations, says, "their careless shaving does harm apparently." The trees must not be too young when shaving is attempted; but some trees have been shaved as many as seven or eight times before being killed by the process.

Whether the bark is removed by stripping or shaving it should be done before the end of the rainy season, and the exposed surface must at once be mossed or covered with some material that will protect it from the sun and wind until the wounds are healed. The trees require careful manuring after the operation.

Increased Production of Alkaloids under varying Circumstances.

Age.—The proportion of alkaloids increases with the age of the bark:—

C. Succiruba,	4	years old,	yielded	1·25 $^{0}/_{0}$	Quinine.
„	7	„	„	2·25	„
C. Ledgeriana,	4	„	„	6·00	„
„	7	„	„	8·00	„

When shaved, the shavings increased per acre:—

C. Succiruba,	at 4	years old,	yielded	250	lbs.	Shavings.
„	7	„	„	560	„	„
C. Ledgeriania,	at 4	„	„	250	„	„
„	7	„	„	600	„	„

Altitude.—Mr. Turner states that nearly twice as much alkaloids are obtained from bark grown at 5,500 feet above the sea as at 1,500 feet elevation. And in the higher altitude the alkaloids are chiefly Quinine and Cinchonidine (the most valuable alkaloids), while at the lower elevation they are chiefly Cinchonine and Quinidine (the least valuable ones).

Cultivation.—The quantity of alkaloids appears also to increase under cultivation, for Mr. Howard lately obtained 5·6 per cent. of Quinine from the descendants of that *C. Uritusinga* which he had sent to India a few years previously—an extraordinary increase upon the usual yield from this species of Chinchona.

Increased Consumption of Chinchona Bark.

With the increased growth of Chinchona bark, the consumption has also rapidly increased; and when the various fever and malarious regions of the world in India, Italy and elsewhere are considered, the still more extended cultivation of these barks is earnestly to be desired.

Importations.

England	1876,	2,535,568 lbs.	1882,	15,599,920 lbs.
U. S. America,	1877,	1,000,000 ,,	1882,	3,700,000 ,,
France	1877,	1,760,000 ,,	1882,	4,860,000 ,,
Italy	1876,	990,000 ,,	1882,	6,150,000 ,,

The Milan manufactory of Quinine produces fifty-five tons of Quinine yearly.

In Spain there has been no increase, and the importation is small.

The Chinchona bark produced in Java is chiefly sent to Holland, and I have not been able to find an account of the amount. The bulk of what is grown in the East Indies is employed upon the spot for the manufacture of what is termed "Febrifugum" or "Chinchona Febrifuge," in which the alkaloids are not separated one from another. The following is Dr. Paul's analysis :—"Quinine 19·4 per cent., Quinidine 2·4, Cinchonidine 27·0, Cinchonine 34·5, Amorphous Alkaloid 7·8, Water, colouring matter and resin 8·9—total 100·0.

This is largely sold to the natives in India, and employed for the troops in that country, and the sales are made by the Indian Government at a price which is said to leave a considerable loss, but is intended to bring this invaluable medicine within the reach of the native Indians.

Quinine Manufactories in the World.

The successful manufacture, or rather the obtaining of

Quinine from Chinchona bark depends so largely upon delicacies of manipulation and of chemical processes, and the expense of the necessary "plant" is so great, that the manufacture of this drug is still in very few hands. There are at present only sixteen known manufacturers in the world—in London 2, Paris 4, Amsterdam 1, Germany 5, Milan 1, Genoa 1, Philadelphia 2.

Von Gorkom says, "The cost of a factory appears to be from £25,000 to £42,000."

Disappointment arising from the Deterioration of the Chinchonas in India.

A very great disappointment attended the early cultivation of the Chinchonas in India, for it was found that, although the plants were vigorous and the bark abundant, instead of yielding Quinine, as it did from the native forests, it produced a larger proportion of Cinchonine, which is a much less valuable medicinal agent. It was, therefore, a source of great anxiety to those who took an interest in this great undertaking; but in order that the subject may be made intelligible, some account must be given of the so-called "Chinchona alkaloids."

Nature and Chemical Composition of the Chinchona Alkaloids.

It has been already mentioned that the French chemists, Pelletier and Caventou, discovered two alkaloids in Chinchona bark, to which they gave the names of Quinine and Cinchonine, but since their date others have been discovered, of which the most important are Aricina, Quinidine and Cinchonidine.

Of these, Quinine is unquestionably the most valuable medicinally, and it was yielded chiefly by *C. Calisaya*, which was, therefore, the most highly esteemed of all the Chin-

chonas. Cinchonine is of comparatively little value, and Aricina possesses no known medicinal value. Quinidine is a feeble modification of Quinine, and is often styled Quinine β to distinguish it from true Quinine, or Quinine α. Cinchonidine ranks high as a medicinal agent, coming next to Quinine.

They are all colourless crystalline bodies, and resemble each other very closely in their chemical composition, all consisting of carbon, hydrogen, nitrogen and oxygen, and differing only in the proportion of this last element, as shewn in the following table:—

	C.	H.	N.	O.
Cinchonine... / Cinchonidine.	40	24	2	2
Quinine ...... / Quinidine	40	24	2	4
Aricina........	40	24	2	6

It appears, therefore, that a small addition of oxygen converts the comparatively feeble Cinchonine into valuable Quinine, while an undue addition converts it into worthless Aricina. The problem to be solved was, therefore, how to cause the chemistry of nature, working in the laboratory of the living bark, to combine a little more oxygen, but not too much, with the Cinchonine now found to be produced in India, so as to convert it into Quinine in the bark.

Method Successfully Adopted by Mr. McIvor.

It is well known that growing plants absorb carbonic acid from the air, and *breathe out* oxygen into it when freely exposed to light, and that this process is carried on, not simply by the leaves, but also by other parts of the plant, such as the bark. Now, in the native forests of the Andes the vegetation is so thick that, as already mentioned, Mr. Markham found it sometimes so dense that the light could scarcely

penetrate even at noon. Under such circumstances the bark would do but little breathing, while the trees themselves ran up until the branches and leaves had overtopped their neighbours. But the most successful mode of planting, in order to obtain healthy trees and plenty of easily accessible bark, was to give the plants plenty of air and *light*, under which condition the bark breathed too freely, and parting with its oxygen too rapidly its juices formed Cinchonine instead of Quinine from deficiency of this element.

Mr. McIvor, therefore, thought that if he could retard the respiration of the bark, by excluding the light, he might restore the formation of Quinine, and he therefore covered the trunks of the trees by a thick layer of moss, and the result confirmed the soundness of his judgment, and the production of Quinine was increased.

Discovery and Character of C. Ledgeriana.

Mr. Ledger has been for a lifetime devoted to the collection of Chinchona bark and seeds in South America, and he has been assisted by a native, named Manuel, who has been an enthusiast in the work. In the neighbourhood of the Rio Mamore, and in the yard of Fr. Simon, is a splendid Calisaya tree, supposed to be five hundred years old, which like the other finest trees, was guarded with such jealousy that it was said "no one but Manuel could get the seed," but he did succeed in obtaining some.

The trees which are *par excellence* "True," or splendid Calisayas, are termed "Rojo," and Manuel says that the "Rojo" has white flowers as well as pink ones. According to him "the Rojo is never found in patches or clumps, like other Chinchonas, but it is found by itself here and there." When it is in flower the leaves are red underneath, but when the seeds are ripening the leaves become dark purple. The Indians consider the white-flowered *C. Calisaya* as the

"Tata" or father tree, and are intensely jealous of Europeans having anything to do with them. They consider that if they were destroyed all the Chinchonas and the Indians would perish. They feel assured that all the Chinchonas growing round about a white-flowered "Rojo" will be of good quality, and they at once erect their huts and set to work, the practical lesson from which is, that in every plantation of Chinchonas there ought to be sufficient "Tata" trees.

The trees produced from the seeds thus obtained exhibit just such an amount of difference from the ordinary *C. Calisaya* as to have received the name of *C. Ledgeriana*, and the bark yields the almost incredible amount of from eight to thirteen per cent. of Quinine, while it contains little or no Cinchonine, Cinchonidine, or Quinidine. The trees, however, prove their close relationship to the ordinary *C. Calisaya* by the rich velvety appearance of the leaves, and the "segmented magnified hairs, a delicate fringe of which on the edges of the leaf is also characteristic of *C. Calisaya*" (Howard).

The discovery of these invaluable seeds has given a new impetus to the cultivation of Chinchona, in India, Ceylon, and Java, and rendered the future prospect bright indeed.

Cuprean Bark.

Recent Discovery of a New Source of Quinine in the Forests of Columbia (South America).

Within the last few years (so recently that Mr. Markham makes no mention of it in his exhaustive work in 1880) a new source of Quinine has been found in a tree growing in forests on the Columbian Cordilleras, near the Magdalena River. These trees are not Chinchonas, but belong to the genus *Remijia* and as the bark has a dull coppery colour, it has been named "Cuprean Bark." The trees grow in

a warmer and drier situation than true Chinchonas, the bark is thick and very heavy, sinking in water, and it contains a variable amount of Quinine, from 0·36 to 2½ per cent. It contains also a large percentage of Quinidine, but no Cinchonidine; and some specimens have yielded a new alkaloid named "Cinchonamine," the properties of which have not been examined. This bark has been imported in such quantity as to have yielded a most valuable amount of Quinine, the supply of which from Chinchona bark was becoming so limited that it was likely to have run up to a fancy price.

That this source of this valuable medicine should have been so long unexplored and unknown seems wonderful indeed, now that it has once come to light; for the trees grow in the same ranges of mountains (the Cordilleras of Columbia) as the Chinchonas which yield the grey bark, and the genus (*Remijia*) to which they belong occupies the very next place to Chinchona itself in the table of the genera of the natural order *Chinchonaceæ* in Lindley's *Vegetable Kingdom*, published so long since as 1846.

"Ord. *Cinchonaceæ;* Sub-ord. *Cinchonidæ.* Genera—Luculia, Ladonema, *Remijia,* Cinchona, Cosmibuena," &c.—this last of which may possibly also yield Quinine and be worth examining, if the trees are sufficiently numerous.

But so it is. The forests were disappearing from Europe as a supply of fuel, and coal was discovered. Coal was in danger of becoming scarce, and the oil wells of America were discovered; and Chinchona bark was rapidly falling short of the demand for the world, when this new source of Quinine first came to light, although it had been for centuries within reach, and merely required "the time and the man" to make it a blessing to the human race.